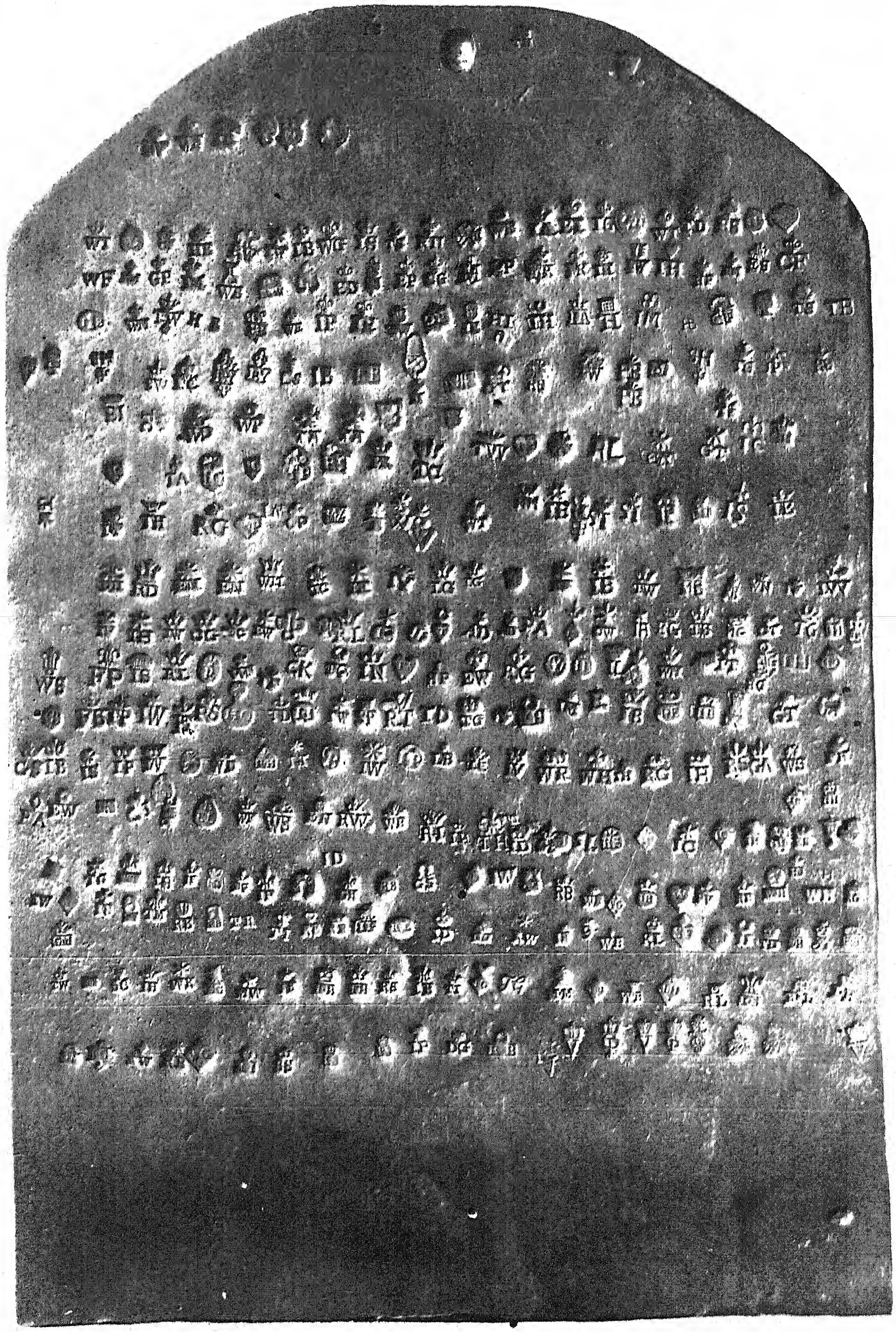
A HISTORY OF FIREARMS



THE PROOF PLATE OF THE WORSHIPFUL COMPANY OF GUNMAKERS

This copperplate is traditionally supposed to have been stamped with the accepted maker's identification mark used by a maker when he was admitted as a freeman of the Company. The mark would serve to distinguish his barrels from those sent in to proof by other makers.

The Worshipful Company of Gunmakers was, and still is, one of the minor City Livery Companies or Guilds, but there were many makers who were simply under the legal obligation to have their weapons proved but who were not members of the Company. It is doubtful if at any time in its history the Company has represented more than a proportion of the London makers.

Fairly full records of the apprenticeship and admission of gunsmiths exist but are not available for the study of the historian. Many of the City Companies have thrown open their records to research students, but in the case of this Company permission has not yet been given. The revenue of the Company is derived from the charges for Proof of arms. The premises of the Proof House are at a site in the Commercial Road, and no other foundations, almshouses, etc., have to be kept up. A few gunmakers are still associated with the Company, but it is not confined to the gun trade or accepted as a representative body or trade association.

The proof plate is, unfortunately, not associated with any records. There is no contemporary accessible record of the makers whose marks these are, and many are unknown. The interpretation of the plate presents particular difficulties and can only be checked from known specimens. Some stamps occur fairly frequently at successive periods. Others are known to be associated with a maker whose name is not the initial or combination of initials shown on the mark. Certain familiar marks do not occur on the plate and are in consequence probably the marks of gunmakers who were not interested in the Company.

In some cases the association of initials suggests a barrel maker X who would make barrels for customers Y and Z, sending up his wares marked XY and XZ in order to distinguish them. In some cases we can assume that an inversion of initials has taken place. John Smith or Smith John being the same individual under the letters I. S. or S. I. This inversion is not uncommon in crude seals or stamps which have to be cut in " looking glass " inversion.

The order of the stamps seems to be roughly chronological, although here and there later imprints occur out of order. The short but blurred top line dates back to about 1680, and the last line bears the stamps of gunsmiths of the last decade of the 18th century. In course of time and by the close scrutiny of marks on pieces in collections it may be possible to resolve the riddle set by the plate. I shall be interested to hear from any collector who can trace any of the marks which occur on the plate and are not among the makers' marks given in this book. The photograph of the plate is reproduced by permission of the Worshipful Company of Gunmakers of London.

A HISTORY OF FIREARMS

By

MAJOR H. B. C. POLLARD

AUTHOR OF "THE BOOK OF THE PISTOL,"
"AUTOMATIC PISTOLS," "MODERN SHOTGUNS," ETC.

WITH THREE COLLOTYPE PLATES
AND THIRTY-EIGHT HALF-TONE AND LINE PLATES

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PREFACE

THE aim of this book is to provide the student and the collector of firearms with a manual embodying the maximum amount of practical and useful information as well as with a general survey of the development of hand firearms. The illustrations are provided not so much for the purpose of showing how much applied art can be developed on a firearm, but mainly to help a collector to identify a given type or piece.

The arms collector may be of antiquarian, artistic or mechanical turn of mind and he may limit his preferences to given periods. The European collector as a rule sets the most recent limit of his scope at the percussion period. The American collector, on the other hand, tends to begin with percussion and collects 19th century and recent pieces.

Rarity knows no rule, and one man will prize an early automatic pistol (and these are now extremely scarce) even more highly than a 16th-century Gothic wheel lock. A rare Colt will fetch its weight in gold, a Scotch pistol of early date may bring a swinging price at auction, and everywhere we hear the same complaint, old firearms are becoming yearly scarcer, prices are far higher, finds few and far between.

In the past the collector has had little guide to the all-important factor of dating a piece. The list of makers' names and dates incorporated in this book is the first serious attempt to simplify this problem. A lesser number of makers' marks and proof marks are also embodied. I am aware that these represent only a small proportion of the marks probably in existence but the collection and collating of armourers' marks is necessarily a long task and would take some years to accomplish. I hope, however, to embody further information in a future edition.

The work of taking photographs of some hundreds of arms has meant many weary hours. In the main, I have relied on my own collection and have selected by preference typical pieces of relatively simple type rather than exceptional rarities and specimens seldom found outside museums or the collections of the very wealthy. With the exception of the few

specifically museum pieces illustrated they represent material still collectable. All too often a "collector's book" merely catalogues the unattainable treasures already in public custody. Pieces not otherwise acknowledged are in the author's collection.

I have to express my grateful thanks to those who have helped me with permission to reproduce photographs or the loan of specimens and material of various natures. These include the Director and Secretary of the Victoria and Albert Museum, the Curator of the Imperial War Museum, the Court of the Worshipful Company of Gunmakers, the Herts County Museum, Sir Frank Crisp, Bart., Major H. Hall, M.C., Mr. S. Haseltine, Mr. Charles E. Whitelaw, F.S.A. (Scots), Mr. T. Vivian Millett, Mr. Murray Kendall, Mr. Robert Churchill, Mr. F. A. Russell, Captain John Ball, Mr. H. Harrod, Messrs. Smith and Wesson and the Colt Firearms Mfg. Co.

The technical difficulties of block making and book production have rendered it impossible to maintain a strict chronological sequence in the grouping of individual items on the plates. Anachronisms have crept in here and there owing to these difficulties, but in the main it has been possible to observe an approximate chronological sequence in the placing of the plates. Where photographed pieces as distinct from outline blocks are not acknowledged as from another collection they are in my own collection, but a continual repetition of "Author's collection" tends to become wearisome.

The index of names has not been cross-referenced with the source of the names, for the greater number are from private collections, sale catalogues, casual pieces, and other impermanent sources. In due course I hope to establish a list in which a representative piece in a permanent public collection or museum can be cited as a reference. In the meantime, I shall be grateful for any names and dates not recorded, or for any further information of interest in the possession of other collectors which may add to the available knowledge of this subject.

In order to avoid confusion I have everywhere used the word hammer in the modern sense of the familiar striking member. In earlier periods the hammer was called a "cock," and the pan cover the "hammer," but retention of the old terminology becomes confusing once the percussion period is reached and I have preferred to be consistent rather than pedantic.

CONTENTS

APPENDICES

LIST OF ILLUSTRATIONS

A HISTORY OF FIREARMS

A HISTORY OF FIREARMS

CHAPTER I

14TH AND 15TH-CENTURY HAND CANNON AND MATCHLOCKS

THE early history of hand firearms is still obscure. They may have developed from the cannon, but it is even more probable that they preceded cannon and evolved from fireworks. If we accept the traditional idea that firearms were in use in the East at an early period it is probable that rockets were the first type of fire projectile. These would be fired from a bamboo tube when it was necessary to give them a definite direction, and the evolution from a wooden tube to a metal one would be a simple step. The second stage of development, where loose powder such as was used in cake form as the propellant in rockets, was put into the metal tube and used to eject a projectile would be easily reached by observing the performance of carelessly made rockets exploding in the tube.

The projectile value and accuracy of crude small bore weapons loaded with meal powder of the Chinese cracker quality was naturally inferior to the bow. The firearm in its original condition as a rocket propeller had, however, the advantage of being an incendiary weapon tactically useful for setting fire to roofs or rendering a position untenable. Military pyrotechnics were associated with siege operations and it is probable that when the narrow limit of size, range and efficiency of rockets was reached there was recourse to the primitive firearm again. These would be more like mortars or small cannon than true hand firearms, for their object would be to shoot a stone or ball or an incendiary javelin to ranges beyond the compass of the rocket proper. The course of a

projectile is predictable, but it should be noted that a rocket is entirely undependable and subject to exterior influences such as windage which may in extreme cases bring it back to its point of origin.

Historians have discussed the passage in the Halhed translation of the Gentoo Laws which are thought to be co-eval with Mosaic times. "The Magistrate shall not make war with any deceitful machine, or with poisoned weapons, or with cannon and guns or any kind of firearms," but it is possible that "cannon" means any kind of siege engine and "firearms" may also mean fire arrows. There is also the traditional encounter of Alexander the Great's forces in India with the use of firearms. The balance of probability points to an Eastern origin for gunpowder and its application to firearms, for the essential saltpetre only occurs in its natural state in dry hot countries.[1]

The East does not seem to have made any important improvement of firearms. This is peculiar when we consider the variety of cutting weapons of good material and design and the general excellence of the oriental armourer's work. So far as can be learnt the application of powder in historic times to improved hand firearms seems to be an entirely European achievement, but there is little doubt that it came to us along the Mediterranean and through Moorish and Arab sources.

The Englishman Roger Bacon in 1267 gives a clear account of gunpowder in his *Opus Majus*. An earlier MS. written in 1249 and in the Escorial Collection also contains a treatise on its powers, and both these accounts are thought to have been derived from a MS. of Marcus Graecus of A.D. 846. The authenticity of this MS. is now doubted and it may be of later date. The first record of its actual use in Europe is a statement by Bishop Albertus Magnus in 1280 that it was used at the siege of Seville in 1247. All the early accounts suggest the use of firearms as siege weapons, but it is not at all clear whether cannon or hand cannon are meant in many early records. Early illustrations show small cannon

[1] M. Paravey in his account to the Académie des Sciences, 1850, states that a Chinese record of 618 B.C., during the Tang Off dynasty, states that cannon bearing inscriptions such as "I hurl death to the traitor and extermination to the rebel."

Early missionaries and Portuguese navigators also confirm that cannon of great antiquity were found in existence when they first reached the East in 1498. See *Artilleria*, by Diego Ufano, Brussels, 1612. Frequent translations and subsequent editions.

Treatise on Gunnery, John Gray, F.R.S., of Cartagena, London, 1731.

on stands which do not appear to differ from hand cannon on shoulder stocks.

In 1301 Amberg had a cannon. By 1313 Ghent was also equipped with a cannon, and the manufacture of wrought-iron cannon was established in Flanders. In 1327 Edward III of England used "Crakys of War" against the Scots, and by 1364 hand cannon had appeared in the field of battle.[1] If one makes allowances for the lag or delay between the appearance of a new weapon and it adoption it is highly probable that no real time interval occurred between the cannon and the hand cannon. Both were probably manufactured in Flanders simultaneously, and the hand weapon made headway as soon as the smaller of the true cannon had demonstrated the utility of gunpowder in field as distinct from siege warfare.

Hand Cannon

The earliest known examples of these mid-fourteenth century hand arms correspond with the pictures of the weapons of the period. There are two types, one a short large bore barrel with a powder chamber of narrower internal and external diameter at its rear. This type is typical of the cannon of the period and is essentially a hand cannon. The second type, which is contemporary with the first, is a much longer barrel of smaller bore, and though coarse and unwieldy it is not a reduced cannon, but a true gun. The specimens in the Royal Armoury of Madrid, figured on plate 1, which were originally from the old arsenal at Majorca, may be taken as representative specimens. The bore of the cannon type piece is $1\frac{3}{4}$ ins., and the length of the barrel proper, 9 ins. The bore of the larger gun type piece is $\frac{1}{2}$ in. and the barrel length 22 ins. Both are roughly stocked with a straight wood shaft and have a vertical touch-hole and priming depression on the upper surface of the barrel.

[1] Edward III used cannon against the Scots A.D. 1327. *Annals of Scotland*, Sir D. D. Hailes, Vol. II, p. 326, 3rd ed., Edin., 1809.

Barbour, a contemporary poet historian, alluded to the novelty of "Crakys of War," Book XIX, *The Bruce*, Pemberton, London, 1790. Specimens, *Ellis*, Vol. I, p. 236, London, 1811.

Froissart, Vol. I, p. 129, Thomas Jhones, ed. 1803; also p. 190, Vol I, *Siege of Stirling by the Scots*, 1340.

Edward III before Crecy in 1346 had gunners on his pay roll. Hallam, *Mid. Ages*, Vol. VI, p. 497. Brady, *Hist. of England*, 1700, Appendix, p. 87. Napoleon III, *Du Passé et L'Avenir de l'Artillerie*, Vol. V, p. 4, ed. 1856. Many references and instances.

EARLY FIREARMS

1. The earliest form of hand gun. This is a simple wrought iron tube lashed to a crude stock. The example is in the Royal Armoury of Madrid and comes from Majorca, being part of the armoury of Don Jaime I of Aragon. This and the following piece date from the 15th century, and if the traditional association is correct from very early in that century. Calibre ·5.

2. A true hand cannon of the same period and from the same source. The short barrel of two diameters is a replica of the contemporary type of common or bombard. The shape of the stock suggests that it was held to the left side or shoulder and fired with a match held in the right hand. These two pieces may be accepted as genuine 15th century weapons typical of the very earliest days of hand firearms. The calibre of the barrel of this hand cannon is 1·6 ins., that of the narrower powder chamber ·6 ins.

3. The first type of match lock with serpentin balanced by the weight of a trigger lever. In these and later match lock arms a vertical shield or " fence " is often found behind the flash pan. This prevented the blast of the priming from blowing the ash or coal of the lighted match into the gunner's eye.

4. The improved match lock with trigger or " tricker " action. The bulk of known specimens of European locks of this type are of this type. A short section of lighted match was held in the serpentin, which was in turn held back, not by a weighted lever but by a spring.

5. Arquebus with match lock and the exaggerated curved or pistol stock in fashion, *c.* 1550, among French and Italians. It was fired from the breast from a cushion or armour.

6. Arquebus with short straight upturned stock, *c.* 1560. Above the match lock can be seen a pierced tube or attachment to the barrel. These are sometimes mistaken for sights, but were touch tubes for preserving the match alight in foul weather.

7. Wheel lock arquebus, *c.* 1590. Here the stock is approaching to a true shoulder type of butt.

8. The mechanism of a match lock " tricker " lock. It consists of a simple lever pivoted to the lock plate. Pressure on the trigger raises the tail of the lever and depresses the nose in the slot or link of the serpentin tumbler. Relatively short movement of the trigger tuns conveys a wide arc of movement to the match holding serpentin.

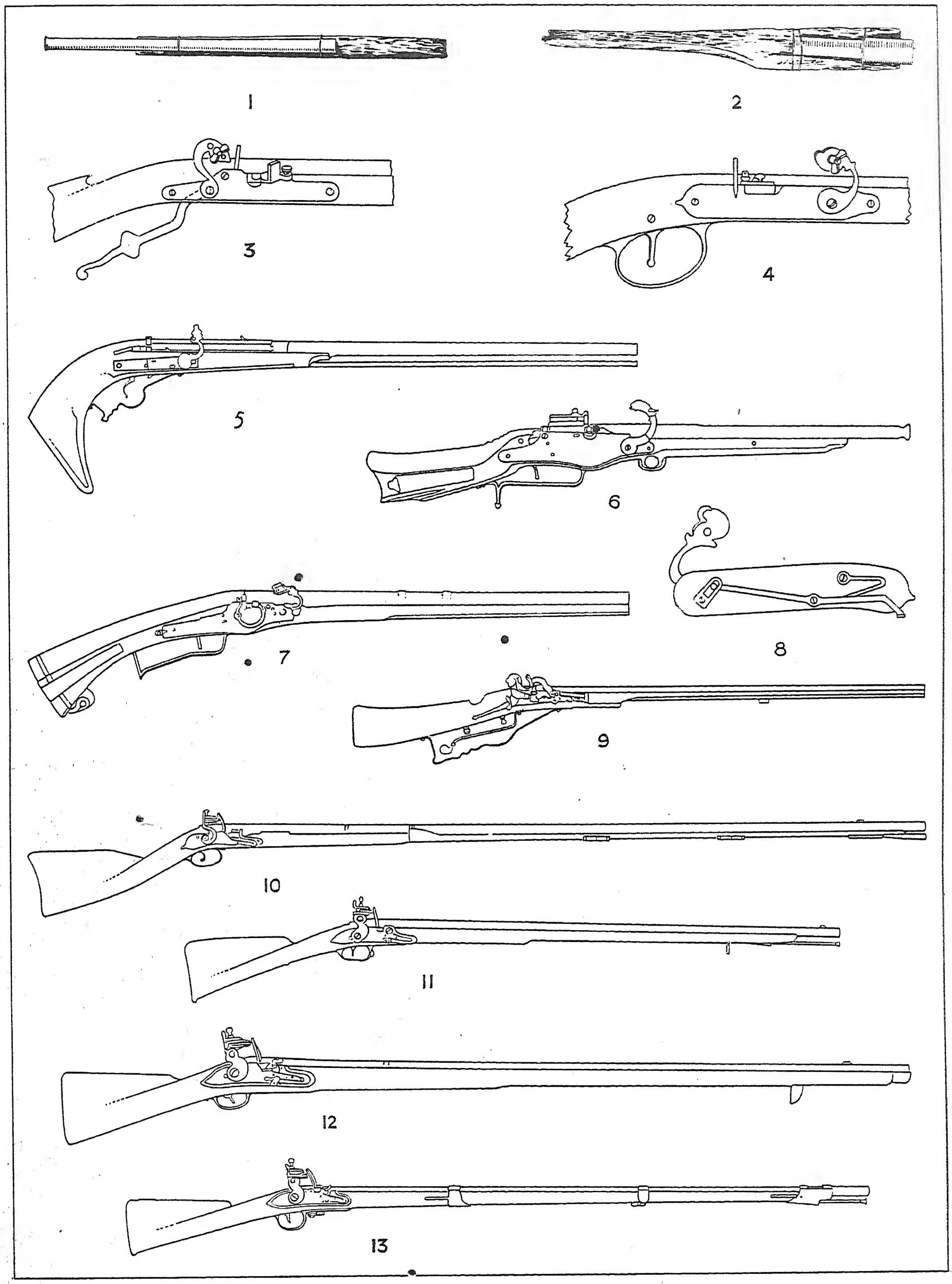
9. Snaphaunce gun, *c.* 1610. In this type the stock is recurved or inverted, but the lines are close to those of the modern gun stock. This recurved stock is also found in Oriental weapons of recent date.

10. Long barrelled flint lock gun, *c.* 1660. The under curve of the earlier reversed stock is still visible in the belly of the butt. The stock as a whole has reached standard design, but the curve of the cheek piece and heel plate still show the influence of the earlier arquebus type.

11. " Brown Bess " flint lock musket, 1680–1830. During all this period there was no material change in the outline of stock or indeed in the weapon itself.

12. Late 18th century wall piece. These were the last development of the old arquebus or musket fired from a rest. Beneath the front part of the barrel can be seen the hook or recoil block which was engaged with the parapet or the masonry of a loophole to check recoil. These recoil blocks are often found on 16th century heavy arquebuses and muskets.

13. The Continental type of flint lock musket. It should be compared with No. 11. Note the bands holding barrel to stock which replace the pins of the " Brown Bess " and also the heavy iron fore-end which serves as a guide to the ramrod.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It is probable that these arms represent the general type of hand firearm used in Italy and Spain during the latter half of the 14th and the first half of the 15th centuries. Hand guns were known in Italy in 1397, and in our own country they appear to have been used as early as 1375.[1]

Gradually the barrels began to lengthen and the calibre to diminish, the stock became more shaped and less of a crude handle and the touch-hole was moved from its exposed position on the top of the breech where wind might blow the powder away to the relative shelter of the right-hand side. Early drawings show arms being fired from both right and left shoulders.

By 1425 we hear of armour being penetrated by bullets and the hand gun begins to show signs of becoming a weapon capable of rudimentary precision. To effect this, the old short barrelled large bore type which was probably originally loaded with a stone ball of large diameter or a slinger's pellet, must have been superseded by the small bore long barrelled or true gun type. The powder used was still the fine meal powder similar to the squib and rocket composition of to-day, and without a long tube in which to complete its combustion it cannot have been capable of giving much penetrative velocity to a projectile. Lead bullets were used, and hardened bronze or copper balls may have been employed at an early date in Germany and Italy. Some old drawings indicate that a sort of crossbow quarrel or reinforced arrow was fired from the guns. Modern ballistic experiment tends to confirm the probability of this, for a very long range and a high degree of accuracy can be obtained from a long cylindrical projectile fired from a smooth bored gun if the projectile's length is

[1] Note 90, p. 242, *Arms and Armour*, Boutell.

Thus from 1364 the town of Pérouse had ordered to be made 500 small cannon, a palm long, fired from the hand. . . . In 1346, at Tournai, that a man named Piers made experiments with the long pointed projectiles which may be regarded as the precursors of the conical bullets of to-day. According to the Thuringian Chronicles of Rothe, "it was the artillery of the Duke of Brunswick in 1346 who were the first to use leaden bullets." Demmin, *Kriegswaffen*, p. iii, ed. 1891.

"At Arras in 1414 this small hand cannon was used for projecting leaden bullets; at the siege of Bonifacio in Corsica in 1420 these bullets even penetrated armour. In 1429–1430 this new kind of weapon was used for firing at a mark, both at Augsburg and Nuremberg. At the close of the 15th century its use had extended to the cavalry, as may be concluded from the expression *Edues scoppetarius* used by Paulus Santimus." Demmin, op. cit.

several times its diameter and its centre of gravity in the first third of its length.

At this period of 1424, the first mechanical device for firing the weapon makes its appearance. Till then the dimensions of the hand gun had been limited because it was essentially a one-hand weapon. It had to be supported and aimed by one hand while a rough stock or projection either butted against the shoulder, rested on it, or passed between arm and body under the armpit. The other hand had of necessity to be free to allow the lighted slow match to be plunged down on the touch-hole.

A consideration of this will show that early hand guns had to be weighty in comparison to their bore if they were not to recoil out of all control. Barrel length was also limited by considerations of convenience, and it was not until the trigger acting *serpentin* or cock holding the match was invented and applied that the gunner had two hands with which to aim and steady his piece. It was a remarkable if simple invention, for it reduced the act of discharge, which had previously been the work of one hand, to a mere pressure of a forefinger, an economy of effort we have not improved upon to date. This application of a finger-operated device to fire the piece may be taken as the point where the true gun develops out of its rudimentary stage as a hand cannon. It becomes a matchlock.

The Matchlock

The matchlock in its simplest form consisted of a long wrought-iron barrel attached by bands to a wooden stock. A touch-hole was bored in the side of the chamber and connected with a flash pan provided with a cover which could be swung aside to expose the priming. In some cases the pan is an extension of the barrel, but more often it is part of the lock. In the rear of the barrel and either attached to a lock plate or working in a slot in the stock was pivoted a curved lever or "serpentin," the lower portion of which, that is to say, the portion below the axis, was much heavier than the top. This weighted portion served to keep the jaws of the serpentin, which held a lighted match, away from the priming powder in the flash pan. The match (*mêche*), a length of rope soaked in saltpetre solution, was held by the serpentin so that when the lower end of the latter which served as a trigger was squeezed or pressed up toward the stock, the glowing head of the match descended into the powder pan, causing discharge.

The serpentin in this simple counter-poised form is very like an application of the ordinary contemporary crossbow trigger-release mechanism. The plain serpentin moving from the rear was soon improved. In place of a simple weighted lever it became a four piece mechanism in which a short movement applied against spring pressure to the end of a long pivoted lever was transmitted by a link to the axis pin of the cock. This revolved on its axis bringing the match down into the powder.

In this type we reach a stage where a short travel and light trigger pressure produce a relatively large arc movement of the cock. To free the latter from the weight and encumbrance of a mass of match it was the custom to carry a separate cord of match round the barrel of the arm or attached to the rest, and only insert in the cock enough of the match for the temporary need.

This adaptation of a spring and lever mechanism with a true trigger to the matchlock reversed the direction of fall of the hammer so that the cock or serpentin now pointed towards the shooter. Examination of early illustrated MS. shows that the two types were contemporary, and that both right and left handed locks were in use. The accuracy of the illustrations is sometimes extremely vague and a conventionalisation does not bother with details; yet sufficient can be made out to differentiate the two kinds. Probably both were used; the simpler one being issued to town levies and the more refined and complicated models being the private property of mercenaries and soldiers of fortune who at this period found their own weapons.

Names of Weapons

The nomenclature of the matchlock is extremely confused and the classification of museum specimens is variable.

Most authorities agree that the musket was originally the name given to a heavy matchlock of the wall piece type which had to be fired from a rest. The name is derived from the habit of calling types of cannon after animals: "Falconet," "Basilisk," "Serpentin" and so on. The word "musket" means a young male sparrow-hawk, and as this was the smallest of the hawks so the musket was properly speaking the smallest of cannon. It was of 1-in. bore.

The musket, the caliver and the fusil were all pieces which were over

EARLY HAND FIREARMS

1. Three barrelled hand cannon of Gothic type. This form of weapon is shown in early MS. Each pan is provided with a pivoted cover. There is no lock and ignition was effected by placing a lighted match on the exposed priming. (Herts County Museum, John Ball Collection.)
2. Japanese match lock pistol. These were made until the middle of the 19th century, but represent the original type of weapon introduced by the Portuguese in 1542. In Oriental match locks the match holder or serpentin moves from the firer as does a conventional hammer. In European match lock muskets the serpentin is reversed and moves toward the firer.
3. Polish match lock rifled pistol. This peculiar weapon is relatively modern and shows with its ball trigger and butt close connection with Cossack pistol design. (Mr. F. Russell's Collection.)
4. All steel wheel lock pistol. South German, *c.* 1580. (Herts County Museum, John Ball Collection.)
5. Italian snaphaunce, *c.* 1640. The lock of this weapon closely resembles drawings of the early true flint lock of 1640, and has an external block screwed to the lock plate to take the blow of the hammer. In true snaphaunces the pan cover is unconnected with the steel of friszen arm and is operated by an internal lever as in wheel locks. (Herts County Museum, John Ball Collection.)
6. Ball butted wheel lock dag, German, *c.* 1550. The wooden pommel is inlaid with bone and antler. The lock incorporates a safety device. (Herts County Museum, John Ball Collection.)
7. Italian snaphaunce of early type. No plate is fitted to check the fall of the hammer. The mounts are of chiselled steel.
8. Ball butted wheel lock dag, South German, *c.* 1580. The wheel is protected by a domed cover. (Herts County Museum, John Ball Collection.)
9. Late Italian wheel lock, *c.* 1640. This shape is typical of the horseman's pistols used in the early Cromwellian period. (Herts County Museum, John Ball Collection.)
10. All steel wheel lock dag, German. Similar to No. 4, but with the typical swamped or expanded muzzle of the true dag type. (John Ball Collection.)
11. Straight stocked wheel lock, South German, *c.* 1590. The ball butt is still retained, but the shape of stock is very straight and only evolving toward the form shown in No. 9. (John Ball Collection.)
12. The lock of the Polish match lock. No. 3 on this plate.

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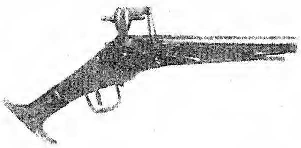

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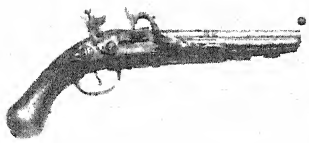

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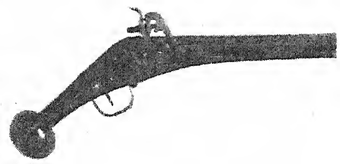

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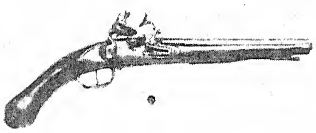

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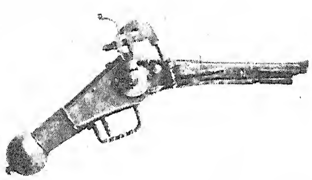

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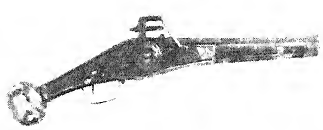

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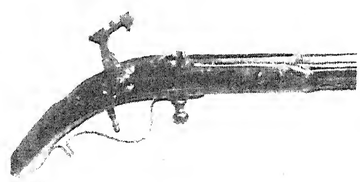

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heavy for hand use. They were customarily supported on a pronged rest or " swine feather," as it was termed when the prongs were prolonged into blades.

The harquebus, although frequently fired from a crotched rest, was of such size as to be essentially a shoulder arm not absolutely needing a rest. The name harquebus, or arquebus, is the same as *hack-buss* (German), literally hooked-gun or tube, and is supposed to be derived from the hooked form of the stock of the early types of matchlock. I am inclined to think that we should look even farther back than this for the origin of hack-buss. The early hand firearm of the hand gun type was a pretty poor weapon for close combat. It was slow to load and use, and was probably combined with a secondary use as a club or mace. It is difficult to find any particular reason for the sudden development of the accepted hack-buss type of stock in wood, for this peculiarity of shape serves no practical purpose whatever. It is therefore probable that it represents in wood a conventional survival of a previous style or type. Now, there exist a few Chinese match lock pistols or single hand cannon about 8 ins. long which consist of a short, extremely heavy iron or bronze barrel of cannon shape and small bore. The breech of these is prolonged to form a long recurved springy hook which curls back over the touch-hole and serves a double purpose. It acts as a match holder with jaws situated above the vertical touch-hole, and it is also a sensible hook for hanging the weapon to the belt or saddle.

Consider the early hand gunners of the time when hand guns began to take shape as field weapons rather than siege accessories. The hand gun once discharged was useless till reloaded, and in the case of imminent assault had to be discarded in favour of sword or bill. The balance of probability points to some kind of a belt hook having been an essential feature of early hand guns. This theory receives additional support if we examine the celebrated early 16th century Monk's Gun of Dresden Museum, a short hand piece with a plunger or rasp lock of the wheel lock principle. It possesses the necessary hook or haaken for hanging on the belt. Certainly early MS. illustrations show a ring as part of a simple rod stocked hand gun of presumably one piece all metal construction. This was obviously for attachment to saddle or person by means of lashings or a suitable hook.

Another explanation is that hack-buss means "catch" rather than "hook" gun, and that the catch meant is the serpentin. Force is given to the argument by the German word "Doppelhacker" applied to match locks with double serpentins acting in opposite directions. As this is simply an abbreviation of Doppel hack-buss it does not solve the problem.

A further explanation of the hack-buss is that many early heavy pieces were provided with a heavy lump or hook-shaped projection near the muzzle and below the barrel. This was actually a recoil block and was retained on wall pieces and kindred arms until the 19th century.

It is doubtful if this interpretation is sound, as the recoil block in question does not occur on many early arms and is not found in many illustrations.

No one of the theories quite accord with such facts as can be gathered, and the philologist further confuses the issue by suggesting a connection between the *arbalète*, or crossbow, derived from *arc de balista* from their similarity to the balista siege engine and arc-a-buss, or tube bow! As firearms came from the Mediterranean via the Latin races it is not improbable that the early Germans and Flemings, who were iron workers and took up the new manufacture, started with a Latinised name for them.

The hooked stock which is accentuated in many examples is simplified to a useful thumb notch or thumb recess in others, but it exists in specimens carved with complicated finger grips on the under surface in a position where the thumb of the firing hand cannot possibly reach it, and the trigger, at the same time.

The name hagbut, or haquebut, is probably a derivation from hack-buss as well, but was used by some writers to denote the type of harquebus with a curved stock of mid-16th century type. The demi-haque was a shorter version of the same arm. The carbine, or carabine, was originally a short barrelled piece with a bore as large as a caliver. This reduction in length would make it suitable for cavalry use. In general the term indicates a shoulder weapon while the term petronel is more properly applied to a hybrid pistol-arquebus. The term may relate to *poitrinal*, i.e. fired from against the breast or cuirass, or more probably comes from the Spanish *pedregal* (stone), and refers to the flint or pyrites lock which superseded the match.

The musquetoon was originally a smaller version of the musket, but came in process of time to mean a semi-blunderbuss as well as a light type of service musket used by non-commissioned ranks. The blunderbuss, or *Tonner-büchse*, was always a big bore short barrelled cannon type piece meant for firing a scattering charge rather than a single projectile. It is customarily bell mouthed rather than cylindrical and can be distinguished by this tapering bore from the hand mortar. Considerations of calibre, weight or barrel length are of little use for classifying old weapons. There is so much overlap between different types that even so simple a rule as classifying arms with barrels less than 30 ins. long as carbines is not adhered to, even in the case of such modern guide catalogues as that of the Armouries of the Tower of London.

The names applied to these variants of the firearm during the matchlock period endured without much variation through the succeeding period of the wheel lock for the two ignition systems were in common use and manufacture at one and the same time. The matchlock endured as standard military weapon throughout the whole period of the wheel lock, and was only finally superseded by the flint lock at the beginning of the 18th century. During this passage of time the original names given to early arms transferred themselves to different types, and there is no similarity of type between the great heavy wall piece musket of 1550, and the ordinary musket of 1725 or 1825.

The harquebus butt developed many eccentricities of shape. Originally very straight, and only dropped enough at the comb of the butt to afford a constrained view along the sights, it was not long before it curved into an exaggerated pistol shaped stock, and then once more turned up again in a shape rather like a reversal of the conventional gun stock or an approximation to the modern Arab type.

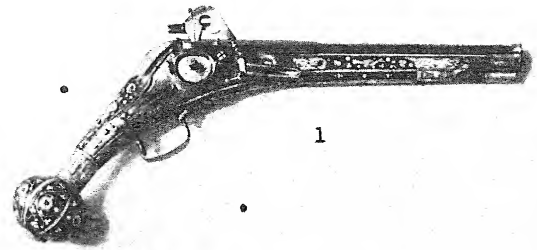
There were many types which could only be fired from a rest, for the butts were too short or too peculiarly shaped to afford a proper abutment to the shoulder. In these the trigger guards were ribbed to accommodate the fingers, and in many cases the butt terminates with an ornamental button.

Few original costumes of the early 16th century exist, but a study of contemporary pictures and histories of costume points to the shape of the stock having been very largely determined by the fashions of the time.

DECORATIVE WHEEL LOCKS

1. German wheel lock pistol with wooden stock inlaid with engraved staghorn. Dated 1593.
2. German wheel lock arquebus inlaid with engraved staghorn. A key recess is embodied in the butt. 17th century.
3. Decorated German wheel lock arquebus with peculiar forward limb to the grip trigger guard. 17th century. The wheel is enclosed.
4. Wheel lock arquebus with guarded wheel enclosed in pierced shield. German 17th century.

(Victoria and Albert Museum.)



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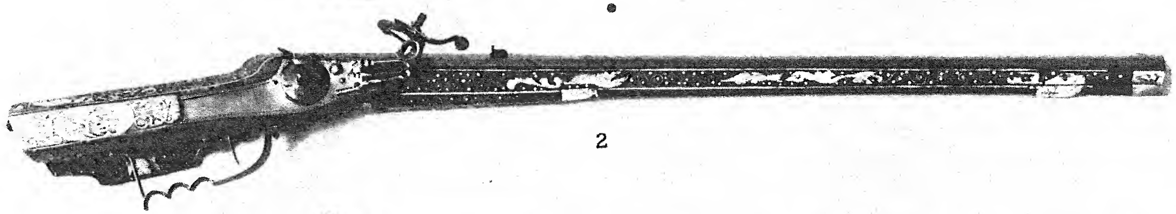

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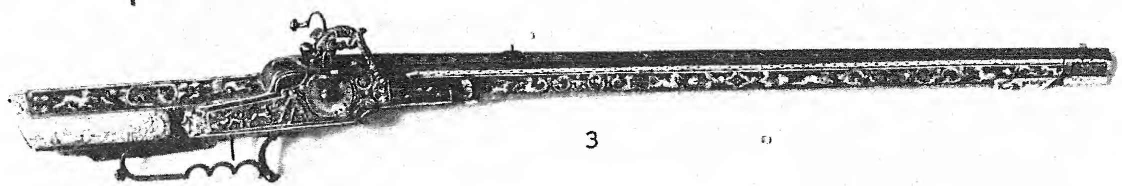

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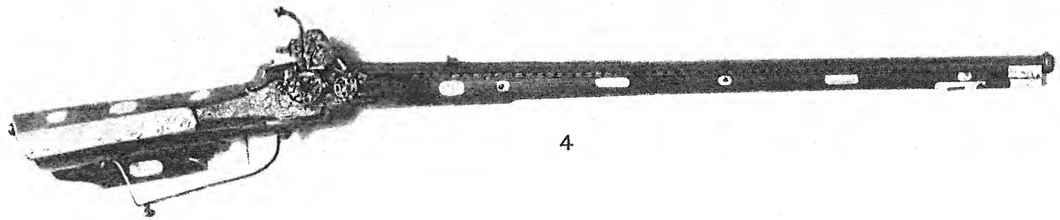

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The German fashions exaggerated the puffed sleeve and we find in German arms a marked shortening of the butt.

It is not until 1600 that the curious exaggeration of the sleeve or the rolls of padding that marked the joint of arm and body dwindle to a vestigial ornament. Then for the first time we find the true gun stock for shoulder abutment appearing.

The pistol-stocked demi-haques frequently have a flat "heelplate." It seems clear that these arms were discharged with the butt against the stomach or side, which was protected by a cuirass, or at least a leather jack. Even if we take into consideration the limited movement permitted to a soldier wearing a cuirass, wadded sleeves (which acted as quilted armour against sword cuts), long leather forearm gauntlets and all the rest of the panoply of half armour, we still find little reasonable interpretation of the odd form of stocks. Some other factor, possibly a complex system of drill or a special way of receiving the recoil must have also exercised a forgotten influence.

The calibre of the piece or its relative weight compared to its bore do not seem to have affected fashion in stocks. Equally fantastic butts are applied to carbines of small bore which could easily have been fired from the shoulder; slender and uncomfortable extensions of butt are applied to carbines of comparatively heavy bore and massive weight which must have been fired from rests. In fact, the design of the stocks of early firearms seems to have been dictated by inflamed fancy rather than any utilitarian motive that we can trace to-day. The old illustrations give us a clue that in many cases the weapons were aimed and fired from the most extraordinary stances. They were held under the arm, or butted against the hip, or fired held at arm's length in a forked rest. Yet the shoulder stocked weapon is apparently contemporary with these other types, and specimens of all types appear to have been made both in Flanders and Germany and in Italy.

The great majority of the specimens which have come down to us are those which are valuable for their decoration. These have survived as objects of art and owe their continued existence to their art value while the simpler specimens have perished, meeting the usual fate of obsolete arms.

It is extremely difficult, if not impossible, to ascribe an approximate date, correct to within a decade or so, to plain pieces. The decorated ones

not infrequently bear actual dates or an armourer's mark which may occur on a piece of known date. Approximations only are possible, for valuable firearms were often converted or brought up to date. Weapons originally built as matchlocks were modified to take wheel locks and barrels from wheel lock pistols adapted to new butts and flint or snaphaunce locks. Later we find many conversions from flint to percussion and from percussion to breech loading systems.

There is also the factor of overlap to be considered. We find three distinct types of arms: match, wheel and flint locks, with their variants all in use together until the beginning of the 18th century. The tendency was for wealthy people to have the latest novelty; the officer caste appear to have been more conservative in their tastes, while the rank and file armed at the common charge were customarily equipped with robust, reliable arms of the simplest and cheapest type possible.

Armouries were maintained by the nobles, and in time of peace it appears they were neglected. We read continually of stocks of "jacks," cuirasses and helmets being examined in sudden emergency and found to have perished with rust and neglect.

Firearms are subject to a greater peril of corrosion than armour, and there is little doubt that the normal stocks of early firearms kept as part of the equipment of a country magnate's house were allowed to rot. Even more serious from the collector's point of view must have been the rigorous periods of disarmament after rebellions.

Experience in Ireland indicates that arms collected for "safe keeping" by even modern governments are seldom returned when the trouble is over.

The manufacture of firearms was not apparently one of the earlier British industries, and there was for long no guild, such as the Bowyers or the Fletchers, to keep the special craft or mystery of the gunsmith's art. On the continent the Gunmakers' or Arquébusiers' Guilds had begun struggles to establish themselves. This involved the amalgamation of two separate classes of craftsmen, metal workers, such as barrel smiths and lock makers, and wood workers to fashion the stocks, but elsewhere recognition or separation come later and there was continued strife between the two interests. In South Germany this amalgamation was established in 1463.

The Gunsmiths' Guilds abroad centred along the Flanders and South German iron belt, and were also found in Italy and later in Spain, where travelling German artificers had discovered the excellent mineral resources available there.

Our own stock of firearms was, so far as can be traced, imported from the Low Countries, and though we had Sussex and Staffordshire iron supplies there is no record of any British small arm manufacture in the 15th century.

In England, although cannon had been used during the Wars of the Roses, hand guns do not appear to have been in general use. They were probably tactically unsuited to the civil warfare of the period, and it is doubtful if ammunition was available except on the Continent.[1]

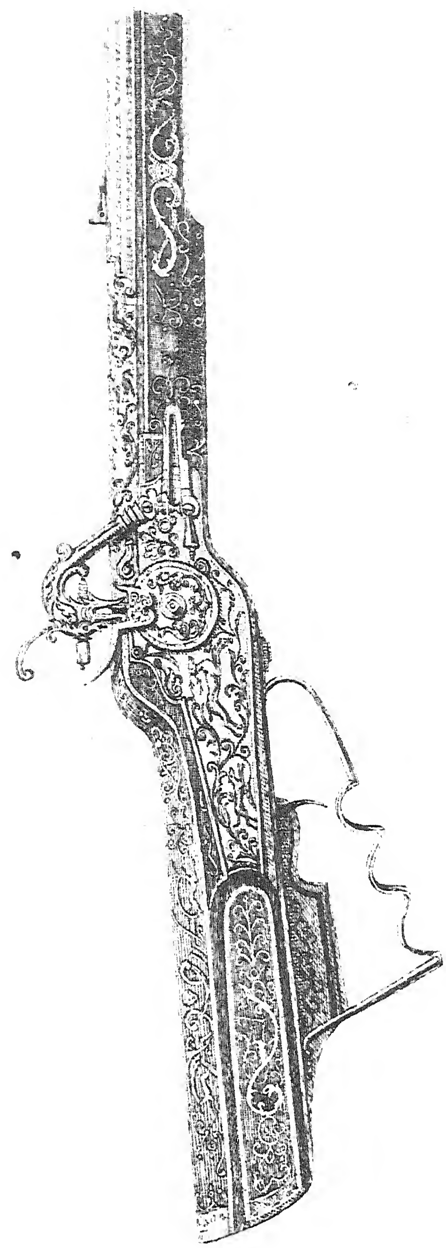
In 1471 Edward IV landed at Ravenspur in Yorkshire on the 16th of March with some 1200 men brought over in armed ships of the Easterlings (the Dutch). He brought three hundred Flemish mercenaries armed with "hand gonnes." The landing was unopposed, events moved swiftly and within a week or two he fought the decisive battle of Barnet, where Earl Warwick was killed. One would expect the Flemish hand gunners to have been noted as participants in the action, but no record of their presence occurs. It seems probable that they were only brought to secure York in the case of resistance and were not looked on as other than siege troops.

In 1485 Henry VII organised the corps of Yeomen of the Guard, half of whom were to carry bows and arrows while the other half were equipped with harquebuses. This represents the first introduction of firearms as an official weapon of the Royal Guard. It is clear that according to the custom of the period foreign mercenaries accustomed to the use of the harquebus were embodied in the guard. In any case, it was necessary to provide skilled armourers to maintain, repair and renew harness, firearms and equipment, and this undoubtedly led to the formation of a small body of foreign mechanics, mostly "Almains" (Germans) at the Tower of London.

[1] Richard II, in 1378, ordered of Thomas of Norwich, two greater and two lesser *ingenia vocata canons*, 600 stones for the same, 300 lbs. of saltpetre, 100 lbs. of sulphuris vivi and one doleam of carbonum de Salugh (willow). *Rymer Foedera*, Vol. VII, p. 185. Richard III, 1484, orders John Bramburgh to make "certain great stuffe of gunpowder," Harl. MSS., p. 185. Richard III: An order to the Constable of the Tower, Harleian MS. 433, mention of Hacquebuts.

ARQUEBUS, EARLY 17TH CENTURY

Early 17th-century arquebus with lock engraved with hunting scene. The drawing was found among original drawings of the Meyrick Collection, but this weapon does not appear to be included in the Wallace Collection or figured among the Meyrick examples engraved by Skelton.



From this nucleus grew up the Guild of Gunsmiths, housed mostly in Minories, hard by the Tower. The gun trade was carried on there until the present century. The turn of the 15th century seems to mark a great period of development and inventiveness in arms. In 1498 rifling was invented. Breech loading, which had been abandoned for heavy cannon, was still used for light culverins and ship's pieces, and attempts were made to produce breech or chamber loading hand firearms. In the first decade of the 16th century, somewhere about 1509,[1] the first wheel lock or "rose lock" was invented. In this system a cock or hammer held a piece of pyrites against a grooved wheel which could be wound up against a spring like a clockwork toy. When the trigger was pressed the wheel was driven round by the spring. The contact of moving steel wheel and pyrites produced a stream of sparks in the priming pan of the piece and fired the charge. It afforded a very fairly reliable and quick method of ignition.

Before passing on to a closer study of technical detail it is perhaps better to review the whole contemporary field of firearms on broad lines and consider the situation as it affected Britain at the beginning of the 16th century.

We had not at that time the same genius of mechanical expression as distinguished the German and Italian craft artificers. Neither were our cannon founding operations on the same large scale. We were building small culverins for ship use when great pieces of position like Mons Meg and Dulle Griete were being made in Flanders.

Henry the Eighth now comes to the throne in 1509 as a boy king, keenly interested in war, arms and armour. The early discontents of the religious troubles in Europe facilitated a flow of travelling or emigrant armourers and gunsmiths. There was interchange of ideas and a breaking down of local guild monopolies. Some ingenious gunsmiths evolved rifling, an invention which in all probability was derived from the ordinary crossbow quarrel on which the feathers or vanes were attached at a slight angle to the axis so that it spun or rotated in flight and maintained its accuracy. The invention of rifling was probably simply an adaptation of this principle to the firearm bullet by grooving the interior of the barrel to impart rotation to the projectile. The principle was, however, imperfectly understood, or quite possibly badly copied, without any true idea of the

[1] Demmin, op. cit..

principle. Early arquebuses with straight non-spiral grooves are not infrequent. It is possible that the makers of these thought that the grooving was the thing that mattered, and that the need for spiral grooving to rotate the bullet on its axis was not recognised by them. It was another two hundred and fifty years before the principles of rifling were really understood.

Far more important than this discovery was the invention of the wheel lock. Till it was discovered lighted matches had to be applied to discharge an arm. Surprise was impossible, mounted fire tactics out of the question. The wheel lock changed all this. Firearms suddenly became practical and useful and the short weapon, the pistol or dag, came out as an important military novelty. For the first time in history here was a firearm with a self-contained ignition mechanism.

I am inclined to think that earlier historians of arms have been wrong in treating the pistol as the diminutive or less important form of the arquebus. The wheel lock made the pistol possible. If we consider the general tendencies of that treacherous and violent age it is obvious that your man of position welcomed the new invention as a new method of self-protection against assassins or personal and political enemies. He knew that a bullet would pierce most armour at close ranges. Here for the first time was a compact, readily portable projectile weapon which could be concealed and would kill a man before he could come to handgrips or within stabbing distance.

This was astoundingly important. Here for the first time was a means of using a gun for instant self-defence. It must have produced an enormous sensation, for it suddenly altered the whole condition of affairs for the weaker man. Till then he had always been subject to the personal element of muscular superiority. Any armour-plated robber knight and his gang of ruffians could raid into a merchant caravan. Small gentry were at the mercy of the turbulent local nobles. It was a predatory age, but the invention of the wheel lock introduced a totally new factor into the equation. The commercial magnate or the knight of little skill at arms could produce a pistol from beneath his cloak—and marauders would keep a respectful distance.

Firearms of all kinds were held in great awe by all classes, for they were looked on as markedly unchristian and likely to inflict an inevitably fatal wound. This point needs consideration. The leading projectile weapon

of the past was the shaft arrow, a piercing projectile which made a relatively clean punctured wound. The crossbow quarrel had a far worse reputation than the arrow, and the bullet was the worst of all. I suggest that there was probably a very sound basis of fact for this traditional variant degree of lethal quality in the respective arms, and that it was not by any means due to superstition and the exaggeration of the value of the innovating weapons.

The crossbow quarrel was blunter, shorter and heavier than the flight arrow and it had a greater striking energy at normal ranges. The shock effect, a very important consideration with projectiles when their military or sporting value is assessed, must have been far greater and the wounds therefore more dangerous.

The bullet not only possessed this quality of heavy shock effect, but also had no piercing point. It simply punched a hole and carried into the wound fragments of armour, clothing and the layers of material through which it had passed.

Cleanliness was not remarkable in the Middle Ages, and the infective value of the bits of foreign matter carried into the wound must have been astonishingly high. Blood poisoning must have followed in a great many cases where the wound itself was a comparatively slight hurt in an unimportant and normally non-vital spot. Thus early firearms probably earned their reputation for deadliness.

There are still countries where banditry, raiding and civil wars flourish, and if we argue from personal experience it is probable that in the Middle Ages a display of armanent was as protective then as now.

Your predatory individual is out for plunder rather than the hazards of personal conflict and prefers to prey upon the weak or defenceless. Tactically he depends on surprise. The caliver man was easy to discount, for in case of ambush he had to get out flint and steel, light his match, blow it to a glowing coal, prime his piece, set up his rest and so come cumbrously and slowly into action.

The wheel lock, though not so dependable as a modern firearm, was not very much slower to bring into use. It discounted much of the advantage of surprise and increased the risks of the attackers. Above all it enabled short firearms to be used from horseback. As all gentry fought mounted, and all transport was horse carried and accompanied by mounted escorts, we are justified in assuming that the true application of the wheel lock is

WHEEL LOCKS AND SPANNERS

1. Wheel lock, end of 16th century, showing external safety device above the trigger. In some arquebus locks this safety device is further adapted to form a match holder for use in event of failure of the pyrites. The stud below the cock is the release of the independent pan cover.
2. Internal view of a 17th century wheel lock showing the massive bridle and main spring.
3. All steel Gothic wheel lock, showing the acid etched decoration. (John Ball Collection.)

A. Combined powder tester, powder measure and match cutter. The pillar slides in a hollow fluted cylinder and is engraved with the measure of varying charges.

B. Sixteenth century powder measure with press lock to the measure.

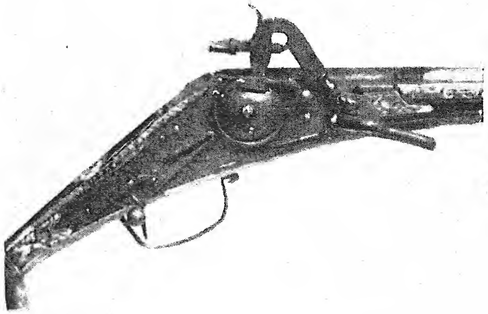
C. Similar measure with a spanner head to fit the axles of wheel locks.

D. Double hammer headed wheel lock spanner with handle of pierced steel terminating in a screwdriver point. (John Ball Collection.)

E. Sixteenth century armourer's tool, embodying mainspring cramp, spanner, pin hammer and screwdriver back.

F. Steel chased spanner and screwdriver. (John Ball Collection.)

G. Decorated spanner and screwdriver with pierced work disc and scale decoration. (John Ball Collection.)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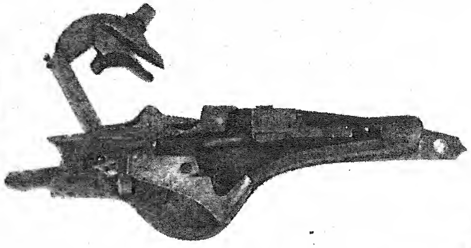
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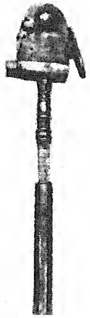
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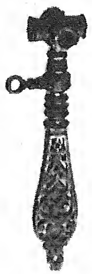
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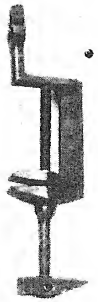
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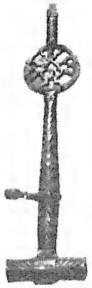
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better conceived *as a new invention of the pistol type of weapon rather than as the application of a new kind of lock to the existing arquebus.*

The wheel locks were of course rapidly applied to muskets and arquebuses, but the match lock was still retained as the usual ignition system for the longer arm. On the other hand European match lock pistols are almost unknown. There are Japanese examples which were probably copied from early Portuguese specimens subsequent to the discovery of Japan by the Portuguese in 1498. There are also the very interesting match lock pistol shields or targets, which are also breech loaders.[1]

These were in existence in 1542. It is usually said that there are no other European match lock pistols, but in point of fact a distinct Polish variety, somewhat like the Cossack pistol, exists, and was made until at least late in the 18th century.

We must pay tribute to the personal activities of Henry VIII. He was keenly interested in artillery and in sport. We find him putting up factories at Greenwich and attending the casting of cannon at the Tower.[2] It is probably due to his personal interest that cannon casting was developed in England, for prior to his reign there is no authentic record of any manufacture of pieces greater than the common culverins. In the records of the Tower of London occurs a note of payments to an employee for injuries sustained "when the King's great gun called Basiliskus was cast and rent."[3] This is one of the first records of our own manufacture of large pieces, and there are indications that we were the first to make brass in place of cast-iron cannon. Some of these big brass pieces were later sent as gifts to Spain and are still to be seen there.[4]

Henry VIII was one of the first men to foresee the value and power of artillery. Sebastiani mentions experiments on the range of guns which were made by him in Southampton Water, and it is likely that the cannon used at the siege of Maynooth were the large-sized brass guns which were first cast in England in the year of its capture. Two foreign engineers whom he tempted into his service first invented shells. "One Peter Baud, French born," says Stowe, "and another alien called Peter van Collen, a gunsmith, both the King's feed men, conferring

[1] *Tower Armouries*, Vol. I. [2] *Sanuto Diaries*, Vol. LVIII, p. 351.
[3] *Armouries of the Tower of London*, Ffowlkes, Vol. I, p. 50.
[4] Escorial Collection.

C

and contriving together caused to be made certain mortar pieces being at the mouth 11 to 19 ins. wide, for the use thereof they (also) caused to be made certain hollow shot of cast iron to be stuffed with fire work or wild fire whereof the bigger sort for the same had screws of iron to receive a match to carry fire for to break in pieces the same hollow shot, whereof the smallest piece hitting any man would kill or spoil him."[1]

The earliest hand firearms in the Tower of London Armouries are two breech loading harquebuses which belonged to King Henry VIII. One is dated 1537 and both were probably wheel locks, although a match lock is fitted to one and the lock of the other is missing.[2] They are of German make.

Another muzzle-loading harquebus of 1546 shows a conversion from wheel lock to match lock, which is rather a curious reversal of the usual progressive alteration to a newer rather than an older type. The shield pistols already referred to are also of this period, and it is noticeable that breech-loading firearms appear to be temporarily abandoned after 1550 and do not reappear till more than a century later.

Henry's influence was remarkable, for by the end of his reign we had the reputation of casting the best and largest pieces of artillery in Europe. This fostering of the gun trade developed national resources and later, when the threat of invasion was a serious menace, our maritime armament was better than might have been expected had its provision been dependent on the too economical Elizabeth.

Small arms, mainly matchlocks and wheel lock pistols were probably manufactured in England in London at this period. So far I have found no direct record, but there is a general inference from records of overhauling stores of arms and the raising of troops that though small arms were largely imported, a common quality of home manufacture was also in use. The existing crafts of armourers, smiths and metal workers were perfectly capable of making small arms of a serviceable if unrefined type.

[1] Stowe's *Chronicle*, p. 584; *State Papers*, Vol. II, p. 237. Froude, *History of England*, Vol. II, p. 300.

Despite Stowe's claim for the invention of the shell by Peter Baud there is a previous drawing by Paolo Santinin, *circa* 1460, which illustrates the principle.

[2] Class XII, Nos. 1–2.

CHAPTER II

THE 16TH CENTURY

FOR practical purposes our study of hand firearms must begin about the latter half of the 16th century. There are a few earlier pieces such as those already referred to in the last pages of the preceding chapter, but in general the earliest pieces found in big collections and national armouries date from about 1560.

It is frankly a very confused period, for we have match locks and wheel locks side by side and sound literary evidence that the snaphaunce was also in existence at the end of the century.[1] There is, however, a very wide difference between the first mention of an arm in literature and its having made sufficient headway to be in common use. This lag or delay element decreases as we come nearer to our own time, and it is probable that it has a direct relationship to the relative speed of the transmission of knowledge and the development of communications. Further the term "snaphaunce" may mean either a pyrites lock or a flint lock of Spanish type, as well as the true snaphaunce lock.

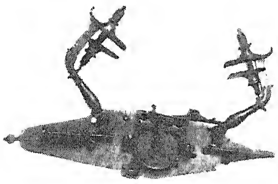
Another point that requires stressing is that until the 19th century the sporting firearm almost invariably leads the way. The principles of invention accepted as indispensable improvements by the sporting public may take half a century or more before they penetrate the military mind and are adopted for military weapons. I am inclined to think that the professional soldier of the past was on the average just as conservative as his 20th century successor.

The knights were the military caste, and there is no doubt that they must early have recognised that the new weapon was bad for them. One and all they feared and disliked firearms, but the longer sighted among them must have recognised that the kings who had been unable to seize

[1] Nye, *Art of Gunnery*, 1641.

GUN LOCKS

1. A double-hammered wheel lock with external guarded wheel. Italian 17th century. (John Ball Collection, Herts County Museum.)
2. Snaphaunce lock, Italian, by Il Negroni Casalecchio, 1794. The style of the decoration and the bent lock plate are those of a century earlier, and it is possible that the lock is a late replica of an older style or is an old lock signed by a late maker. The steel of the snaphaunce lock is separate from the pan cover, which is an independent sliding member operated by internal mechanism.
3. Dog lock, *c.* 1650. No half cock bent exists on the tumbler, but an external hook or dog engaging with a spur on the rear of the hammer serves as a half cock and as a safety.
4. Pyrites lock, late 16th century. These locks have hitherto been falsely described as early flint locks. The peculiar long-stroke hammer and the rotating steel loosely fixed to the pan cover show that they are pyrites fire locks for use with the rather weak and friable pyrites instead of the harder flint. The lock plate shows a closer connection to the match lock than to the wheel lock, and the cock, with its elementary release, may be a forerunner of the true dog lock.
5. Inside mechanism of No. 3, showing the curious scear mechanism.
6. Wheel lock of simple type with lock plate bent for a fitting to a bent pistol grip, *c.* 1620.
7. Early Scotch dog lock. Note that the hammer has the curious bend of the Scotch type and that a stop block is fitted in front of the breast of the hammer. The lock plate shows that the lock was originally a snaphaunce and that the steel pan cover is a later alteration. Compare with No. 10. (Mr. F. Russell's Collection.)
8. Italian flint lock, *c.* 1650. Note external mainspring operating on the toe of the hammer.
9. Spanish flint lock, *c.* 1650. Note the external mainspring acting on the heel of the hammer. The short sharp fall of both Nos. 8 and 9 should be noted.
10. Moorish snaphaunce lock. Compare the style of the lock plate and the arrangement of shock block, etc., with the Scotch dog lock, No. 7. The disc-ended priming pan is distinctive of Moorish and Scotch arms. Many Moorish locks have also dog lock hooks fitted. (Mr. F. Russell's Collection.)
11. Italian snaphaunce lock, showing sliding pan cover drawn back.
12. Early type of flint lock, *c.* 1640. The early hammer is typical, and it should be noted that it is not secured to the tumbler by a screw, but is, as in the snaphaunce and dog lock, held from the inside of the lock plate.
13. Percussion pistol lock by Nock, 1825.
14. Interchangeable inside hammer Bolton flint lock by Nock, 1790.
15. Back action percussion lock, 1835.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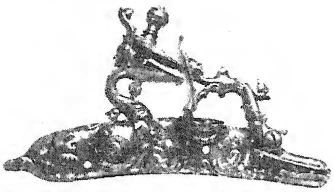
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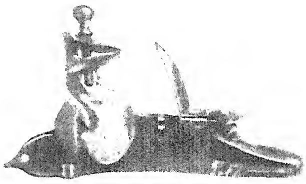
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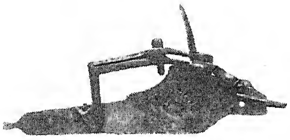
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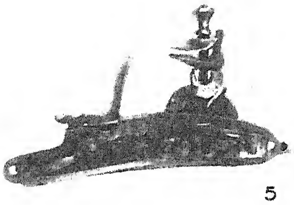
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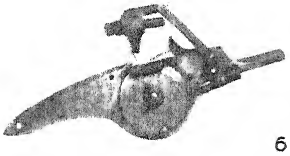
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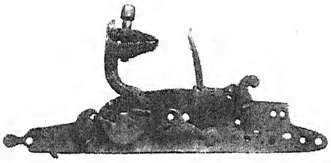
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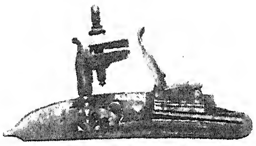
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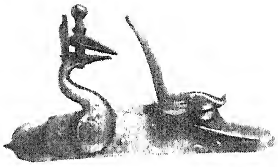
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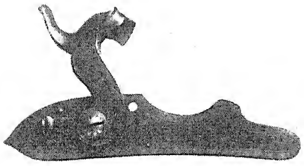
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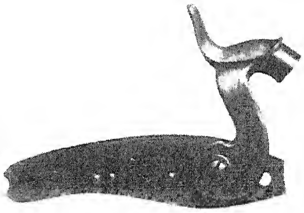
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supreme power, and who were endeavouring to break down the remains of the old feudal system had now a mighty ally. Firearms had a political significance which was obvious at the time—if neglected by historians since. Firearms more than anything else introduced a democratic risk into the old game of warfare.

From the sporting point of view the gun was different. It had advantages over the crossbow, and in the short form of a carbine or long barrelled pistol it could be used from the saddle. This was impossible with the crossbow, which had to be held steady lest the quarrel should drop off the grooved stock, and it was also impossible to use the long European bow mounted.

The hunting of those days was not very arduous. Deer was plentiful, and anyone who has hunted wild deer with the Devon and Somerset to-day will recognise that though the deer can easily outstrip and outlast the fastest horse—a straight-through hunt is exceptional. Deer are lazy and tend to take covert and drive out another deer to face the chase. A huntsman riding close to hounds is often much closer to the deer than is usually recognised. The forest chases of this period must have been fairly thick in cover and checks frequent. A short-ranged weapon was all that was needed. Very often the hunting was not a chase but a drive, and deer were driven by hounds and beaters along a definite confined path to slowly pass a butt where the hunters lay in wait with arbalest and arquebus. Firearms were recognised as hunting arms as early as 1515,[1] and a book on sporting firearms appeared in 1535.[2] A personal record is that in the biography of Benvenuto Cellini, 1530, who makes his own powder and goes out shooting mounted, with his harquebus at the pommel of his saddle on his little brown Turkish horse.

The tendency of the early period was undoubtedly toward a short arm, and the rapid reduction to the dag or pistol type of one hand weapon was probably checked by that Statute of Henry VIII which ordained that no firearm should be *less* than 1 yd. in overall length, butt included. This point shows the popularity of pistols.

A very large proportion of the wheel lock arms preserved to us are highly decorated with typical Renaissance hunting scenes inlaid in ivory,

[1] *Ordonnances de Chasse Francis I of France.*
[2] *Ballestes Mosàuetas y Arcabuces Pablo del Fucar*, Naples, 1535.

horn and antler. The same type of decoration or carving occurs on the pistols or dags when these latter are of all-steel manufacture, "White tackes,"[1] and if there is any chasing or engraving, this is usually "after the antique" rather than sporting in character. It is difficult to avoid the suggestion that the all-steel dags were essentially military weapons meant to harmonise with bright steel harness rather than designed for sport. Gold damascene on a russet ground is also an indication of war weapons. Many of the pistols were decorated with cherubs or grotesque masks and are not specially dedicated by any decoration motif to either sport or war, but could be carried without impropriety for either purpose.

In the earlier pistols the barrels are of exceptional thickness and solidity, customarily bell mouthed but square muzzled. Later the nose of the muzzle became rounded or chamfered. This chamfering would help to reduce recoil as it would deflect rather than be driven back by the powder gases emerging at the muzzle behind the departing ball. It may seem improbable that the old gunsmiths knew of this effect, yet it is one which could easily have been found out by accident or design, and the result noted as an improvement on flush-faced barrels. We use the reverse of the effect to-day to enhance the recoil effect in gas operated machine guns. It might be urged that the chamfering of the muzzles was either purely decorative or to help in replacing them in a holster. These alternative suggestions do not quite meet the case, for in many cases a sharp line would be artistically more harmonious, and holsters must necessarily have gaped wide to admit the clumsy stocks and locks.

This massiveness of construction which is so noticeable in the barrels is also noticeable in the heavy locks and the unwieldy pommel ended butts. It was all part of the design for this type of weapon. It handled a relatively heavy ball, and in order to obtain penetration a heavy charge was used. Cuirasses were tested for pistol proof, but the swift decay of armour shows that only the best or heaviest could stand the test. The musket ball would probably pierce any cuirass at close range.

The weight of the early pistols was comparatively high, but without this weight this recoil would have been terrific and their accuracy even more problematical. They were not clumsy because the artificers could not make a graceful light weapon, but purely because they were essentially

[1] Brander MS. Grose, *Antient Armour*, 61.

armour penetrating pieces. Massiveness was necessary. Later, as we trace the development of the pistol, we find the arm becoming lighter and exquisitely graceful; forged twist steel replaces the old thick iron tubes and barrels are paper thin at the muzzle. These weapons were all that was needed to penetrate an unarmoured man, but they would not have stood up to the heavy powder charges of the earlier 16th century pieces.

The earlier pistols also served a further purpose as emergency maces or clubs. Once fired they were slow to reload and span. In a mêlée they were discharged and reversed to serve as clubs or even missiles.[1] Their pommel butts, besides helping to give them balance, were well adapted to this secondary purpose. Combined war axes or hammers incorporating a wheel lock pistol are by no means rare, but figure in most museums. Many are modern forgeries.

The wheel lock mechanism itself was comparatively simple in its original plain form, but mechanical refinements, soon added to it, changed it into a complicated piece of work. There are very wide variations in wheel locks: double hammered locks, double locks to fire barrels below one another. Independent double hammered locks firing two successive shots with one winding are relatively common types. The wheel may be internal or external to the lock plate, enclosed or open, and in some cases, particularly with late light harquebuses, the spring and chain mechanism rotating the wheel are also exposed on the outside of the lock plate. This characteristic is noted on French pieces in particular, but is not confined to them. Very late wheel locks are sometimes self-cocking, the lifting of the pyrites cock setting the wheel.

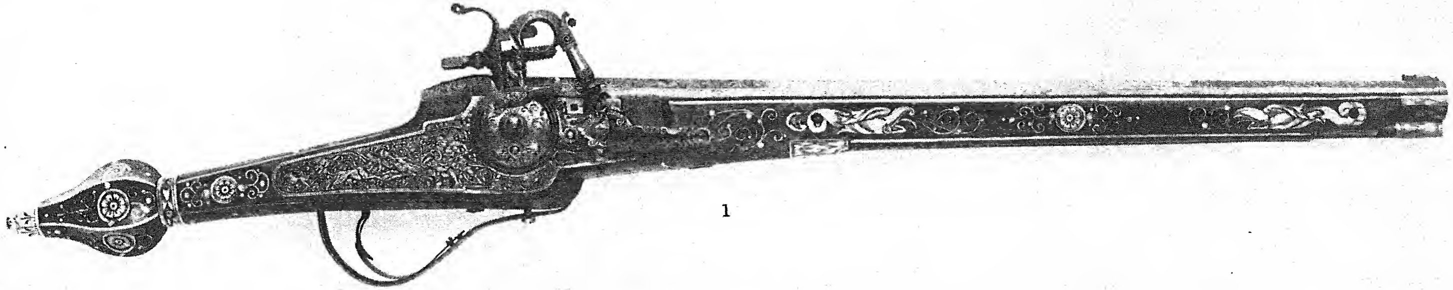
The name "pistol" as applied to firearms is variously ascribed to the reputed town of origin, Pistoia, and to the calibre of the arm which is said to have equalled a "pistole," a current coin of the early 15th century. This statement of the coin calibre origin has been copied by most authors of the 17th and even 20th centuries and finds place in encyclopedias and dictionaries of authority. Demmin[2] says that the name was probably derived from "pistallo," a pommel, rather than from "Pistoia," the city of that name, and that they appear to have come originally from Perugia where, as early as 1363, they constructed "hand cannons" only the length

[1] See account of Battle of Longside, 1568, on Scots Border, Sir James Melville.

[2] P. 71 Black's *Translation*, 1870.

WHEEL LOCK ARMS

1. Wheel lock pistol, late 16th century. The barrel is elaborately chased with figures and marks, and bears the royal shield of France in gilt and damascened with gold. The lock plate is engraved with a boar hunt and the stock inlaid with engraved ivory. The weapon is French, and a spring is shown fitted to the trigger. This refinement was not introduced again till Manton applied it to sporting guns about 1800.
2. Wheel lock rifle, German and dated 1605. The stock is inlaid with incised ivory marquetry. The stud forward of the enclosed wheel and below the hammer is for independent release of the pan cover. (Victoria and Albert Museum.)



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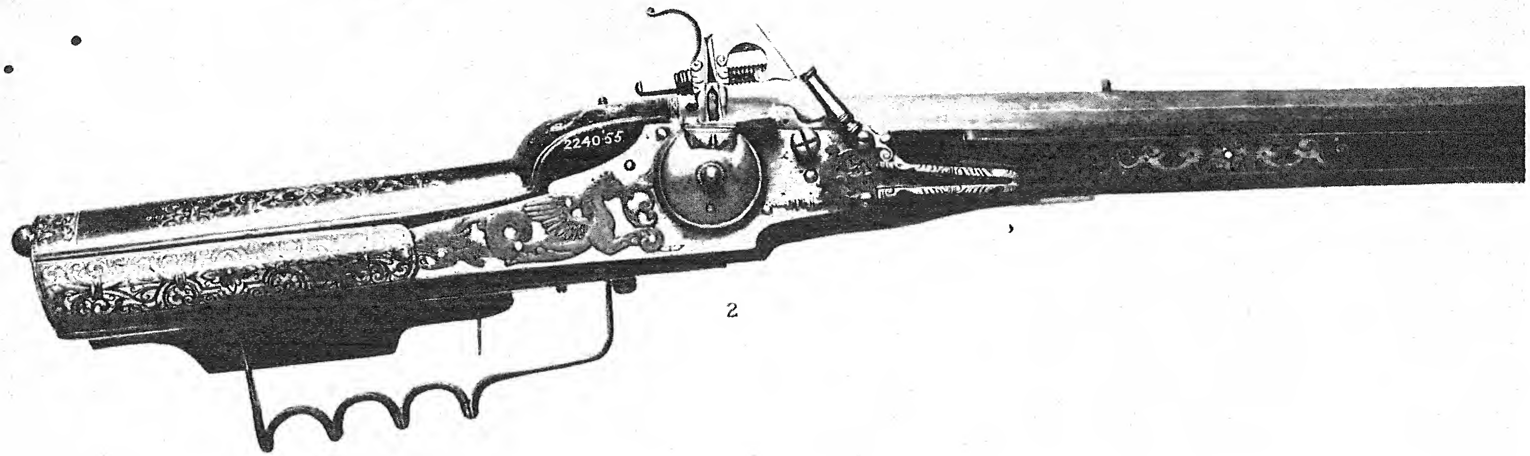

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of a "palma," about 9 ins. He then adds "the German Tercerole" was a small pocket pistol, probably of Italian origin.

No one appears to have taken the trouble to examine this matter more closely, but research at the British Museum discloses that the coin "pistole" at the beginning of the 16th century was a Spanish gold piece about 1·23 ins. in diameter, which later decreased in diameter and thickened in depth to a minimum French gold coin of ·95 ins.

The connection between the words "pistole" and "tercerole" was too obvious to be neglected, and further research disclosed that though a coin called a "tercerole" was unknown to the younger officials of the coin room, the senior curator recognised it as "terzarola," a 13th to 14th century gold coin reckoned as the third part of a "Genovino." There is no specimen in the British Museum, but it exists in Italian collections, and though stamped carelessly and oval rather than a true disc, its diameters vary from ·51 ins. to ·65 ins. An examination of recorded pieces shows an average calibre of ·53 for nearly all pistols, variations over ·68 and below ·38 being extremely rare. For practical purposes it may be taken that the calibre of ·577 or 20 bore (twenty round balls to the pound) represents the major limit of a one-hand arm. I can fire this standard 20 bore cartridge in a double barrel pistol without discomfort, but it must be confessed that few experienced shots care to use calibres and charges of this extreme size. Arms of this calibre made in the 20th and 19th century for the purpose of extreme stopping power against Soudanese fanatics, or to use buckshot against Irish murderers, have usually employed a reduced charge less than the equivalent 20 bore shotgun standard, but I have had pistols built by Lancaster to take the full charge and the standard 20 bore cartridge.[1] This charge approximates very closely to the old black powder rule of thumb which was "enough powder to cover the ball when laid on the palm of the hand."

The traditional bore of the pistol, if we accept the coinage comparison (a conclusion difficult to ignore if we accept the "tercerole," a word still current in German and Belgian arms catalogues as a term for a small pistol), is an average of 1 in., a bore of 3½ bullets to the pound (·977 equals the modern 4 bore) which is the maximum limit of calibre which can be fired

[1] These special arms were supplied to General Sir Hugh Tudor, K.C.B., General Macready, and Captain W. V. Darling and the author at Dublin Castle, 1921.

from the shoulder or from any piece other than a wall piece provided with a recoil block. The original pistol was therefore probably a large bore shoulder piece and not a one-hand weapon at all.

In general, little reliance is to be placed on the old books except where they quote authorities which can be verified. Demmin appears to have been obsessed by an inferiority complex which bade him claim a Teutonic origin for Spanish and Italian weapons, which far transcend German pieces in mechanical and artistic value. He sacrifices much in his desire to find a German priority claim for everything. The later 19th century French and English compilers appear to have followed Grose, Demmin and the French with little critical scrutiny of their conclusions. The same kind of thing goes on to-day, and sale catalogues attribute to Brescia all kinds of Austrian and even Spanish work, and class 16th century specimens on some fantastic basis of their own. A recent sale at Sotheby's, where a Forsythe percussion lock type Spanish gun of 1820 was acclaimed as 1720, furnishes a *reductio ad absurdum* of pseudo expertise. (It was later examined critically and the original date of 1820 deciphered, while the companion piece with an unfaked date was found in another collection.) I am inclined to think that errors in the other direction are even more common. Pieces classified as "late 16th century" are often of the first half of the century. Very crude and early examples of match locks might often antedate 1550. Wheel locks almost identical with, and often apparently earlier than dated specimens of 1535–1550, are classed as late 16th century, and on challenge no one can say why. The style of ornament, and the pieces are often plain, is not always enough to indicate with precision even the country of origin, and in most cases it will be found that reliance has been placed on old books rather than definite study of a particularised subject.

The critical examination of these early weapons brings up a great number of extremely difficult points. In many cases the weapons appear to have been built to fit an existing lock rather than designed and executed as a harmonious whole. This is particularly noticeable in the case of pistols of early type where a lock appropriate to a heavy harquebus is mounted in a stock of peculiar clumsiness so that the trigger and trigger guard are so near to the pommel that it is not easy to get any satisfactory grip of the weapon.

These wheel locks were traditionally expensive articles, and there is

no doubt that early arms were often altered, adapted and brought up to date. Compared to the locks the barrels must have been relatively inexpensive, except in the cases where fine work had been lavished on the furnishings. The natural tendency of design must have depended on practical needs, and the change from full armour and heavy swords to the half armour and long rapier of the Elizabethan period must have involved a change from the cumbersome angular reiter type with the dropped ball butt and almost rectilinear outline of stock to the type which still preserves the pommel and general shape, but which has generally refined the arm and substituted curves for the almost straight lines of the original.

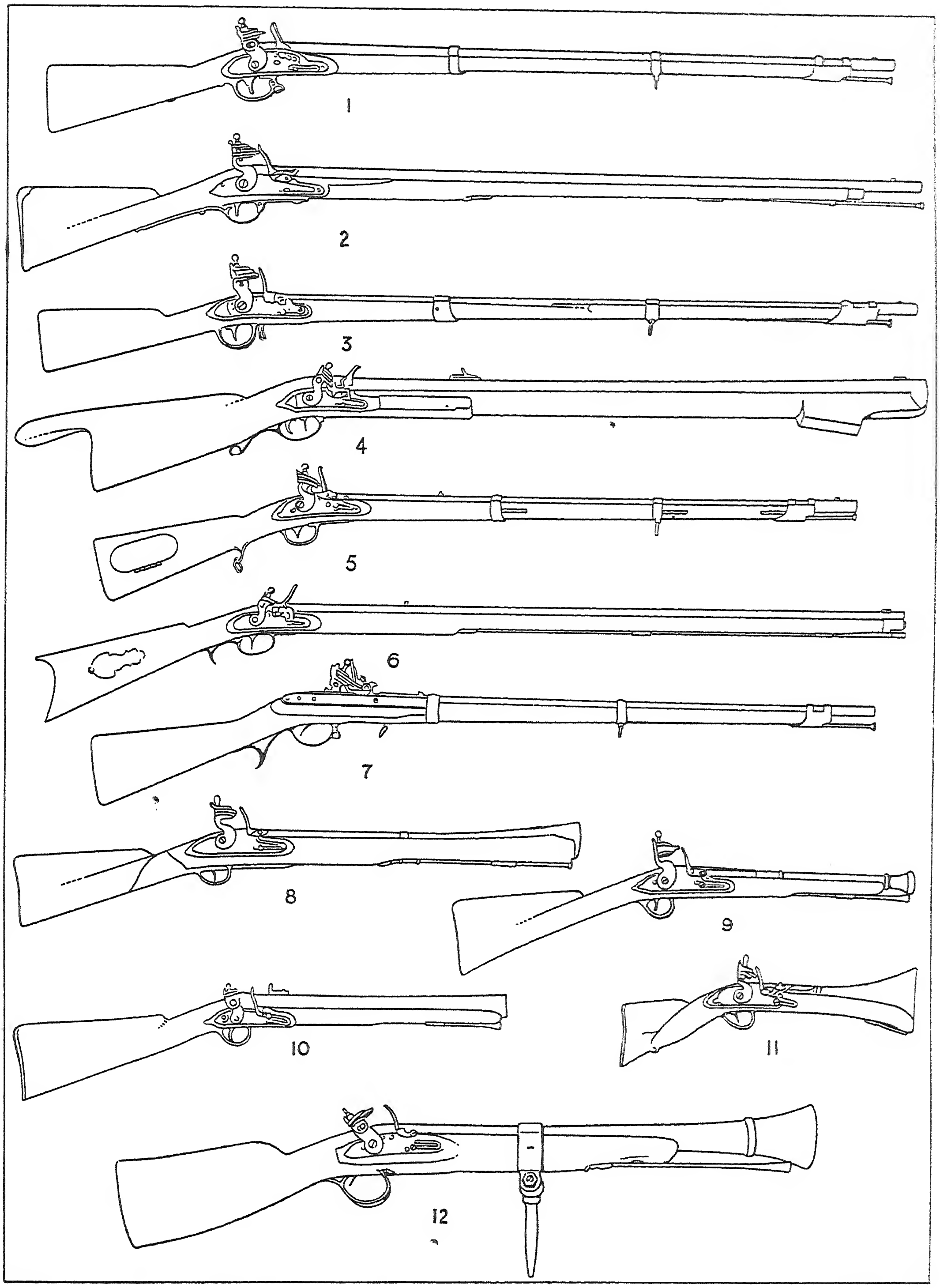
The trigger guard begins to move towards a more comfortable position instead of cramping itself low down in the stock near the pommel. This latter takes a flattened or ogival shape, often fluted, making a more convenient grip than the spherical knob. The angle of butt to barrel straightens to a very fair pistol shape, and a wheel lock pistol of 1565–1575 is a very fairly practical weapon. The changes do not stop here though, for the straightening of the stock continues, and many specimens of the end of the century show an almost straight line effect, an accentuation which is almost as bad an error as the original sharp angular drop.

The Italian pieces, and some Spanish pieces, are relatively progressive in design, but those of German make seem to be far more conservative. It is thus possible to find in 1570 an Italian wheel lock pistol with a light slender pistol grip, rounded trigger guard, and the general lines and balance of a much later type of pistol, side by side with a contemporary German pistol which still clings to the uncouth clumsiness of the early heavy dag. The Spanish seem to have liked pistols with a miniature gun stock rather than the ball butt or ordinary pistol grip pattern. This fondness for a little gun butt, about 5 ins. long and of no practical use, endured as typical of Spanish arms of a certain type until the late 19th century. Miniature blunderbuss pistols, with these short gun stocks, were also popular among the Moors and Arabs, and there is often a very marked relationship between Spanish and Moorish taste and design which shows in their firearms.

The development of the wheel lock is not the only perplexing question with regard to firearms during the 16th century, for somewhere during the latter half of the period the snaphaunce lock, the forerunner of the true flint lock, was invented. The date usually given is 1585, but the weight

FLINT LOCK TYPES

1. French military musket, Charleville model, 1777. This weapon has the double-necked hammer and the metal fore end and ramrod guide. The earlier French Service muskets, from 1717 onward, had swan-necked hammers, semi-octagonal flash pans and lacked the metal fore-end. The earliest U.S. muskets were modelled on this Charleville type, and from 1795 muskets of this type were made in America. Detail variations make these weapons of interest to American collectors.
2. English Tower musket. Date from 1690 to 1820. Note that the barrel is secured to the stock by pins and not by bands, as in other muskets. The heel plate and fittings are customarily of brass, but sea Service arms have sometimes iron furnishings. The drawing is a conventional representation rather than a faithful sketch of any particular specimen. The locks of Tower muskets bear the Royal cipher, G.R., when subsequent to 1715. Earlier pieces have W.R. or Queen Anne's cipher surmounted by a crown.
3. United States musket model of 1799. A close copy of No. 1, the Charleville model. The lock is marked Springfield and U.S.
4. Dutch rifled wall piece with hair trigger. Date, 1813. The recoil block near the muzzle represents a return to the earliest types of the 16th century arquebus.
5. United States rifled musket by S. North, 1825. The fittings are of steel and the stock has a patch box let in, rather in the style of the Kentucky rifle. Calibre ·53.
6. Typical Kentucky rifle by Golcher. The peculiar shape of the stock, with its silver heel plate, is distinctive of these rifles. The long heavy barrel is of relatively small calibre, ·42. The mounts are in silver and the stock of finely figured wood, probably maple.
7. Hall's breech loading flint lock rifle, *c.* 1820. Invented in 1811 it was used in the American Civil War of 1861. It was the first officially adopted breech loader issued to U.S. troops.
8. Typical bell-mouthed blunderbuss. These have barrels in iron, or in better qualities in brass or gunmetal.
9. A smaller type of cannon barrelled blunderbuss with smaller bell mouth. These were used as coach or travelling weapons and are often fitted with folding bayonets.
10. Austrian rifled carbine. These curious short arms had a relatively enormous calibre in some cases, ·95 of an inch. They were used for boar shooting at close ranges and are sometimes mistaken for rifled blunderbusses, a weapon which does not exist.
11. Oriental blunderbuss pistol. These arms were much in favour with mounted Arabs and are still made as bogus antiques for the tourist market.
12. Swivel gun. These arms are often mistaken for big blunderbusses, but were purely boat weapons. They were mounted on the bows of small boats and were used when boarding or attacking slavers. Similar arms were used on forts and stockades, but the true stockade gun is not a blunderbuss, but an enlarged Brown Bess musket of one inch bore and six feet overall length.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of modern opinion is that the snaphaunce must have been invented very considerably earlier.

After all it is very difficult to find any logical reason for assuming that it took nearly a century before some mechanically-minded person simplified the complex wheel lock and reversed the action so that in place of rubbing a fixed stone on moving steel, moving stone was brought to relatively fixed steel. The use of flint or pyrites and steel was the only way of striking a light known at the time; it was in daily use and the wheel lock system was by no means the simplest method of producing the effect. It is rather a peculiar point that we do not know when flint and steel superseded pyrites and steel for domestic use in tinder boxes. Pyrites was in use in Sussex and Norfolk until 1820. Flint may not be as old for universal fire lighting use as we are inclined to think.

The great point about the wheel lock was that it generated a powerful localised stream of sparks in absolute contact with the priming powder in the pan. The snaphaunce type generated far fewer sparks for far less duration of time, and these had to fall down into the exposed powder in the pan below.

The wheel lock used a piece of pyrites instead of flint, and it should be noted that this mineral varies very widely in strength, friability and "sparking power." It is not suited to the direct impact blow of the later flint lock, where the stone has to bear the full shock of compressed main spring, and has to perform the added heavy duty of throwing back the steel or pan cover against a second spring. Pyrites gives its best "fire" with a rubbing contact or "swipe" effect under relatively modest pressure. It is my opinion that there is no doubt that many of the locks now classed as early flint locks are not flint locks at all, but simple pyrites locks, probably derived from the match lock rather than the wheel lock and earlier than the true snaphaunce.

The typical pyrites lock has a curiously long hammer set relatively far back toward the tail of the lock plate. The hammer is curved or bent almost to a true right angle and carries at the extremity of the long arm a pair of jaws clamping together with a screw. The pan is attached to the lock plate and covered by a pivoted arm working against a light spring and bearing on its upper surface a removable steel or frizzen. The inside mechanism of the lock is extremely simple. Instead of the very heavy

forged steel spring and chain and link movement of the wheel lock, a relatively light spring is used. It is hardly more powerful than those fitted to match locks and generally weaker than those applied to flint arms. A covered cam on the tumbler bears against the nose of the mainspring, and a projecting catch on the hammer itself is held by a projection of the vertically pivoted scear which passes out through a hole in the lock plate to engage it. There are thus only three main limbs and three mainsprings (main, pan cover and scear and spring) in the whole assembly.

The angle of the fall of the hammer is totally distinct from that of a true snaphaunce or a flint lock, for in these pyrites locks the arc of movement is such that a properly set piece of pyrites strikes relatively lightly and at a descending angle on the top of the curved steel and wipes against it for a full inch of travel before the thrust forces back the steel and uncovers the pan. At the end of the stroke the hammer lies with its jaws parallel to the axis of the barrel rather than at the usual sharp flint lock angle with the jaws pointing down into the pan. Some pyrites locks appear to be conversions from match locks.

The simplicity of the mechanism and the very clear resemblance of the long hammer to the cock or serpentin of a match lock suggest that the type was first evolved by adapting a match lock. It is to all intents and purposes a match lock in which the jaws of the serpentin have been adapted to take a piece of pyrites; a steel for this to strike on has been adapted to the cover of the pan. Frequently this is attached by a screw and is free to revolve. This freedom of movement appears too to be intentional, and the spring has been made rather heavier to ensure a sharper contact and sufficient energy on the part of the falling hammer to throw the pan cover and steel back. It owes nothing to the standard wheel lock design except the use of a piece of pyrites, and it is particularly to be noted that these locks will not work properly with a flint.

The lock *à Miguelet*, or miquelet, is the familiar Spanish type of lock where a heavy external mainspring acts on the heel of a massive external hammer pivoted in a bridle screwed to the outside of the lock plate. These pieces usually have a very wide but low steel pan cover with a channelled striking face. The powder grooving is deep and the whole action is designed to produce a very quick hard blow with relatively short travel of the moving parts. The scear and scear spring are the only parts of the lock

behind the plate and are usually of the intercepting type. A half cock stud springs out to receive a sharp projection on the hammer, and the full cock stud is usually a short projection of the scear nose through the lock plate. The principle is simple and efficient, and Spanish locks of this design continued until the late 19th century. It is essentially a flint and not a pyrites lock and delivers a very powerful blow.

The snaphaunce is sometimes confused by writers with the Spanish lock or with early flint locks in general. It is, however, a totally distinct type and is closely related to the wheel lock. A snaphaunce arm can always be distinguished, for it has an independent steel or frizzen which is not, as in all other types, made to act as a flash pan cover as well. The flash pan cover of a snaphaunce is a sliding plate actuated by a long lever inside the lock which bears against the tumbler of the hammer. This flash pan mechanism is identical with that found in the wheel lock.

Unlike the miquelet, the snaphaunce has enclosed mechanism and the mainspring is usually inside the lock plate. The scear as a rule engages with bents on the tumbler of the hammer in the usual way, but variant specimens are found, particularly in early ones, in which the scear pierces the lock plate and engages with the outside hammer, as in the Spanish lock.

The snaphaunce was the forerunner of the standard flint lock, and as it was only made for a limited time, can be ranked as one of the scarcest of all types of lock.

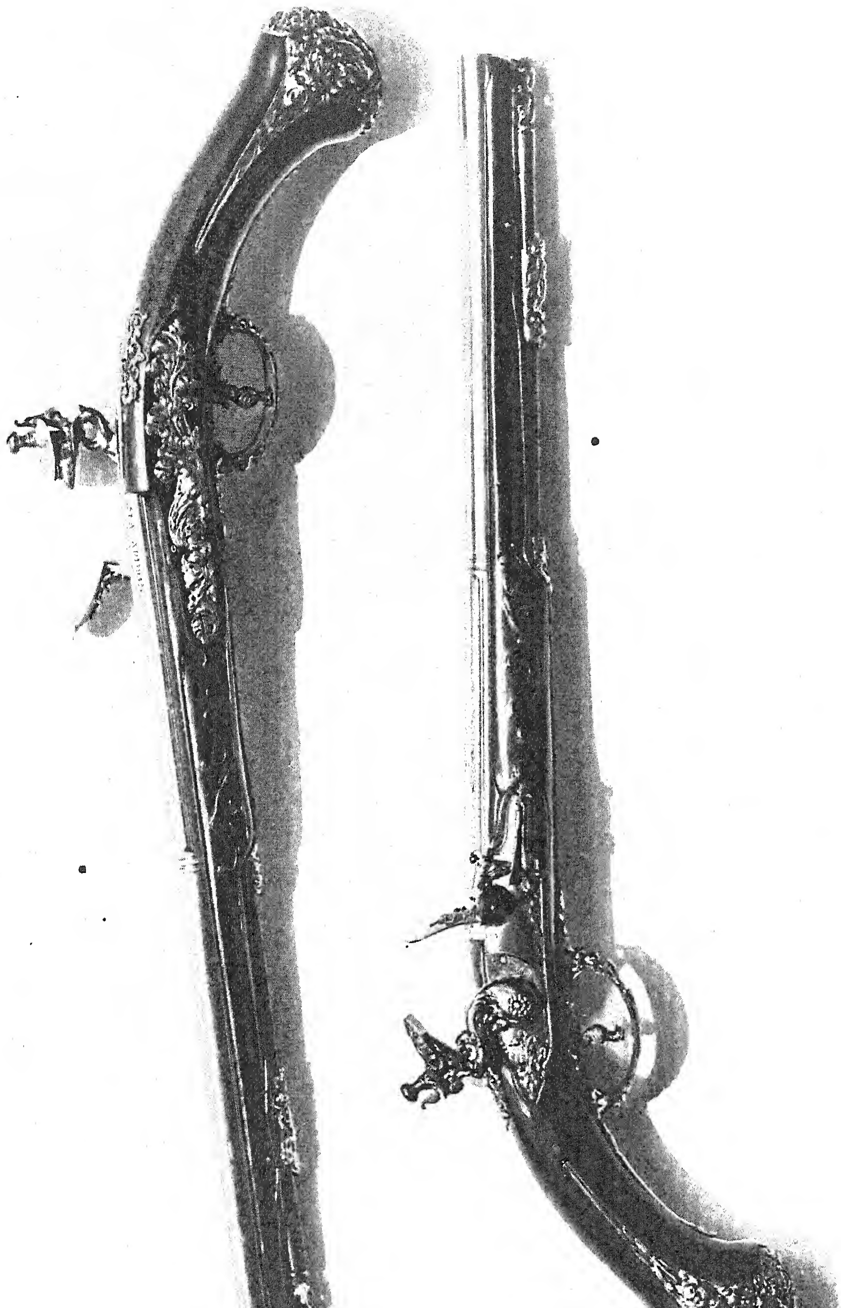
It is doubtful if we can accept the old dates and the old legends with regard to the origin of these pieces, the snaphaunce and the miquelet. Though very distinct types they have been confused and the tales of their origins are not reliable. According to some oft-repeated accounts the name snaphaunce is derived from "Snap-Haens," a word applied to Dutch chicken thieves. It is, however, much more probable that the name came from the falling action of the "cock" or hammer "Schnapp-hahn"—a cock pecking. The derivation is just as likely onomatopœic, i.e. "Snap-cock" from the noise of the hammer fall. It has also been corrupted in French to "Chennapen" and in English to "Snap-harmce."

The date of its origin is customarily given as *circa* 1580, but there is little doubt that locks of this kind were in existence by 1550.

The name lock à Miquelet, for a Spanish lock, is said to have come from the Spanish or Portuguese marauders who were known as "Miquelites,"

DECORATED FLINT LOCK PISTOLS

A pair of holster pistols by Lazarino Cominazzo, mounts in chiselled steel, Italian, 17th century. The arms of Lazarino Cominazzo were highly esteemed as the most perfect of their day. The barrels were exceptionally light yet strong, and have in many cases a fluted reinforced breech. This ornamental forging is sometimes developed into spirals or a herring-bone pattern and serves to mask the somewhat massive metal of the breech. The barrel muzzle is usually exceptionally trim. The locks were usually the work of other craftsmen, but peculiarities of stocking suggest that Lazarino was responsible for the design and balance of the weapon as a whole. The double-necked hammers of this pair are unusual and did not become general until a century later. (Victoria and Albert Museum. Specimens lent by Mr. Hollingworth Magniac.)



and carried these arms. There appears to have been a distinct Peninsular origin for the lock. It soon reached Italy, but was apparently not such a popular form with the Italian gunmakers as the extremely graceful snaphaunce. There is also a possibility that the flint lock principle was brought back thither from Japan by Portuguese navigators, the Japanese having long used flint and steel mechanical lighters on the ordinary gun lock principle. These little flint lock strikers were usually in egg shaped containers and were used as pipe lighters. Their date of origin is uncertain.

Some of the earliest snaphaunces show a combination of both elements,[1] and it is probable that the two systems flourished at one and the same time and represented an improvement on the wheel and pyrites locks of the earlier part of the century. A rather interesting point is that the earlier Scotch snaphaunces of the late 16th century are very like the Moorish snaphaunces which were made by Moorish native craftsmen, without much alteration of design, until the beginning of the present century. This similarity between Spanish, Moorish and early Scotch pieces is of interest, and may throw light on the origin of the Scotch pistol which later became a specialised type. It is also a clue to certain clever recent forgeries. The Spanish lock is sometimes called a "demi-battery" lock.

The invention of the typically Spanish lock is attributed by some writers to Simon Macuarte the Second, about 1560. The Emperor Charles V imported two brothers, Simon Macuarte and Pecho Macuarte, master craftsmen, "maestros" or "maese," of German origin, to Madrid in 1530. The original name appears to have been Markwordt, and a craftsman of this name is found in contemporary records of Augsburg gunmakers.

The first two of the Macuarte family or school were extremely renowned and were also known as "de Hozes," for they signed their work with the mark of a sickle (hoze) often acting as the bracket for an enclosed date.[2]

The sons Felipe and Simon Macuarte II (el Hijo) also used this mark, but customarily with their names as well. The invention of the Spanish type of lock is attributed to him, but although there are many pieces of work by the Macuarte family in the Royal Armoury of Madrid, no snaphaunce or flint lock with his mark is listed, and all existing specimens are

[1] No. 736, Mid-16th century pistol, Tower Armouries.
[2] See catalogue Armeria Real.

wheel locks. It is worthy of comment that the earliest snaphaunce piece in the Madrid collection and prior to 1608 is distinctly oriental in influence.

The true flint lock for guns, pistols, and all types of firearms represents a simplification of the two types. The enclosed mainspring and simple scear are borrowed from the snaphaunce, and the simple combination of steel and pan cover in one from the Spanish lock. The independent sliding pan cover is done away with, and the hammer or cock itself is now made separate from the tumbler and attached to it on a squared head and retained there by a screw. In the extremely rare very early flint lock the hammer is still secured from within the lock plate, as in the contemporary snaphaunce.

We cannot determine the date when the simple flint lock first came into use, but so far no specimen that can be definitely cited as 16th century has been traced in any museum. It is, however, probable that pocket pistols on the Spanish lock and pure flint lock principles were in use far earlier than former writers deemed probable. Inevitably the early flint lock was cruder and cheaper than either wheel lock or snaphaunce, and plain pieces always tend to disappear.

The arms forms of the 16th century can be divided into the following main types, but there are infinite varieties and fancy pieces which are not uncommon, but hardly common enough to be recognised as a true type. They are customarily duplications or expansions of the common principle.

Match Locks

Type I. Plain lever and serpentin.
II. Plain falling serpentin with spring and scear. Cock depresses only.
III. Tricker or trigger mechanism acting against a spring. Movement of trigger raises and depresses the match serpentin by a link motion.

Wheel Locks

Type I. External wheel.
II. Enclosed wheel or guarded wheel.
III. Internal wheel inside lock plate.
IV. External spring and chain to wheel.
V. Double locks, double hammers, etc.

Pyrites Locks

Type I. Long hammer.

Snaphaunce Locks

Type I. Standard Italian type.
II. Type with shock absorbing block on lock plate.
III. Moorish or Scotch with disc ended priming pan.

Miguelet or Spanish Locks

Type I. External mainspring. Scears pierce lock plate and intercept hammer tang.
II. Oriental variations of this form.
III. Italian semi-flint lock on this principle.

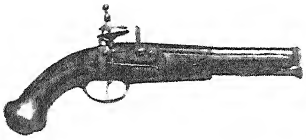
Note on variations in wheel locks. In nearly all wheel locks the hammer or cock points toward the butt. The only exception I have noted was a lock which was probably half a double lock very extensively altered at a subsequent date. Double hammers, one facing each way, are not unusual and are customarily late 16th century work. Their use was to attain a greater certainty of fire by having a spare pyrites bearing hammer ready for use if the first one gave out. Most locks of this nature have to be rewound, but in some a ratchet detent device has been incorporated so that a second pull on the trigger permits the further revolution of the wheel without rewinding. A late rare type is self-winding, the spring being compressed when the pyrites hammer is lifted.

As the evolution of the wheel lock progressed, safety bolts engaging with slots in the wheel were developed, and a separate stud mechanism permitted the priming pan lid to be reopened for repriming without letting down the spring of the arm. Double arms with under and over barrels are common. A similar attempt at a two-shot pistol is found in pieces with two locks designed to fire two successive charges placed one above the other in the same barrel. Most of these had double triggers, but single trigger examples discharging both locks successively are not unknown.

The key, spanner or winder, which gives us our modern word "spanner," was nearly always separate from the lock, and was detached from it when it had been wound up. These keys are sometimes replaced by a fixed double-

FLINT LOCK PISTOLS

1. A Spanish or Catalan pistol, *c.* 1700, showing the typical lock and heavy barrel.
2. Under-and-over revolving pistol, Italian, *c.* 1680. Early double-barrel guns were made in this manner. To revolve the arm the trigger-guard is pulled back and the barrels turned by hand to present a second steel and pan. (Herts County Museum, John Ball Collection.)
3. Typical " Queen Anne " cannon barrel pistol by Freeman, dated 1703. Note the typical lock and club stock with silver lion mask. Really a screw type breech loader and unprovided with ramrod pipes.
4. Typical cannon barrel of *c.* 1680. The base of the barrel is more octagonal than the previous example and the hammer shows a slenderer swan neck. The forward extension or finial of the trigger guard covers the proof and makers' marks.
5. Transition type, *c.* 1720, retaining the cannon barrel, but with an ordinary flint lock. The butt is turning from the rather Dutch club shape toward a ball or crook butt. Pistols similar to this, but with butts shaped as Nos. 2 and 12 on this plate, were in sparing use as early as 1645. Note that no cannon barrel carries a ramrod.
6. Silver mounted cannon barrel by Klett, *c.* 1740. The Continental style of butt is retained, but the barrel is not unscrewable.
7. Italian flint lock by Lazarino Comminazzo, *c.* 1700. (ex Watkin Wynne Collection.) These pistols have the grip of the butt peculiarly flattened. The barrels are remarkable for lightness and strength, and often carry spiral or herring bone flutings on the breech section.
8. Typical light horse pistol of *c.* 1750, by Barbar. Here the typical Continental butt has been refined and curved to the English grip.
9. An early Spanish dag with typical gun type stock. These date from 1600, but were made without much alteration much later.
10. Austrian cavalry pistol, *c.* 1720. These have heavy chased brass mounts and semi-octagonal flash pans.
11. French horseman's pistol by Devillers, *c.* 1730. The barrel is chased with trophies and damascened in gold on a worked ground.
12. Double-barrelled Italian pistol, *c.* 1700. (Herts County Museum, John Ball Collection.)
13. Double-barrelled all-steel Écossais or Segallas pistol. These were made in Flanders, but are often marked London. They date from the early to the late eighteenth century and were widely used as pocket pistols.
14. A single all-steel pistol of the foregoing type marked Wilson, London, but without proof marks. A foreign made weapon.
15. A four-barrelled under-and-over revolving pistol of the same type. (Mr. S. Haseltine's Collection.) The butt of this piece is flat sided rather than dished as is usual with the type.



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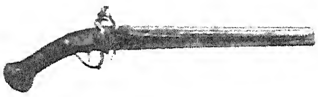

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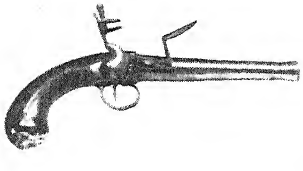

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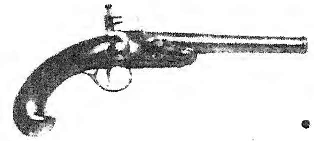

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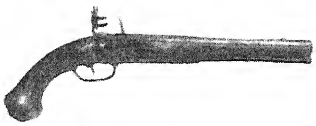

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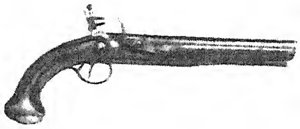

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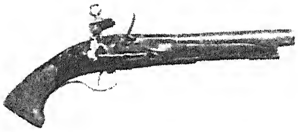

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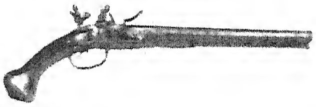

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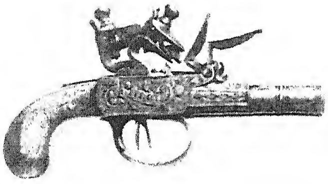

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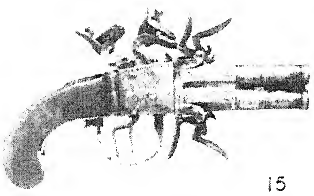

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ended butterfly lever pinned to the nut or by a combination key-lever-dagger dismounting tool.

In rare cases only a half-wheel is used, and one or two examples exist where a spiral spring drives a plunger rasp instead of a grooved wheel. I have seen a specimen where the wheel was geared up to a clock-work drum similar to the ordinary clock. It was of late Austrian manufacture, *circa* 1700.

Breech-loading wheel or match lock arms using separate chambers were relatively well known in the early 15th century, the principle being copied from the chamber loading culverins then in common use. Gas escape at the breech would render the arms difficult to use and the invention was premature.

The revolving principle of a multi-chambered gun fitted with a common barrel is found in wheel lock, snaphaunce and even match lock arms.

The hair trigger or " stecher " is in principle an additional lock which delivers its hammer blow on the scear tail, and effects a lighter and far more precise pull-off than can be done by trigger pressure alone. It was a German invention of about 1540, and was probably of considerable value, for the trigger mechanism of an ordinary wheel lock is necessarily heavy. The scear pin engages in a hole in the rear surface of the wheel, and the trigger pressure has to pull this engaging stud or scear out of the hole where it is held by the pressure of the great mainspring. If the arm is well and safely constructed this needs force, and a light trigger pull meant a rather dangerous and unreliable arm.

By the end of the 16th century rifled hunting carbines were common, and light smooth bored fowling pieces, meant for small shot, were in general use. Game was, however, not shot flying. The rifles were of comparatively heavy calibre, ·68 to ·75, and often elaborately sighted. They were, however, for use at short ranges, and the heavy ball carried in a very high trajectory. This bad principle of the heavy ball, small charge and high trajectory was not overcome for a long time, and endured as typical of European rifled arms until the American War of Independence demonstrated the value of the Kentucky principle of a small patched ball and a higher velocity with a materially flatter trajectory at all practical ranges.

The early shot guns or fowling pieces were of rather small calibre, often ·45 and seldom surpassing ·54. The gun or piece of the average country

gentleman was, however, a weapon which could be used with round ball as well as shot, slugs, or swandrops. In small sea enterprises, explorations and private warlike enterprises, there is good ground for believing that several slugs rather than the single bullet was the preferable charge for many kinds of pieces. Grose quotes Sir Edward Hawkin's account of his voyage to the South Sea, A.D. 1591.[1]

"In his discourse General Michaell Angell demanded for what purpose served the little short arrows, which we had in our shippe. . . . I satisfied him that they were for our muskets. They are not as yet in use among the Spaniards, yet of singular effect and execution as our enemies confessed. . . . Hereof they proved to profit themselves after, but for that they wanted the tamp kings (i.e. wads), which are first to be driven home, before the arrow be put in, and as they understood not the secret they eject them as uncertain, and therefore not to be used."[2]

This use of a tamping or special wad is interesting. Tow or spun-yarn was the customary wadding of the time, and when the early cartridge of powder was introduced the paper of this superseded the use of special wadding or cut patches to wrap the ball.

The passage may also throw some light on another point in Grose, where Sir John Smith[3] writing concerning the seige of Calais in the reign of Queen Mary, states of Captain Berwick, "he doth make no distinction betwixt a currier of warre and a harguebuse." Grose quoting several points from the MS. concludes that the currier was of the same calibre and strength as a harquebus, but had a longer barrel.

Currier seems, however, to be only a derivation of *quarreaux* or quarrel, the arbalest bolt, and it is more probable that the pieces were long barrelled harquebuses designed for the long range shooting of crossbow quarrels at sieges.

The 16th century represents a period of incessant confused warfare. Italy, France, Spain, Germany, Great Britain and the Netherlands were all engaged. Alliances changed and fluctuated, political and religious reasons for war alternated with astonishing rapidity. The new world was being discovered by Cortez and Pizarro, the Far East by Portuguese navigators. It was a period of general warfare everywhere, and arms were

[1] Grose, *Ancient Armour*, p. 117.
[2] P. 164, Sec. LXVI.
[3] Harleian MSS. No. 4685.

a necessity, not only to the soldiers, but to every individual. Armies were composed of levies and mercenaries, under command of professional soldiers. Navies were sailed by shipmen and mariners, but commanded by soldiers. The regular army had not begun to exist, and there was no uniform weapon or standard military calibre, every piece being furnished with a mould with which the soldier could cast his own bullets.

The degree of fervour with which war was prosecuted varied very much. The Spaniards and ourselves and the Dutch took war seriously, but the Italian battles, conducted mainly by mercenaries, were not exceptionally fatal. Both weapons and armour came to be treated more with an eye to display than vigorous adherence to utility. Plunder was more important than decisive military action against forces. The tactics of the time involved the employment of mounted troops equipped with pistols. These are thought to have begun with the German reiters of 1540, though Paulus Sanctimus alludes to *Eques scoppetarius* in the late 15th century.[1] These, and their successors in other armies, would charge down on a line or square of pikemen (since pikemen represented the bulk of the infantry forces), fire their pistols and wheel away to reload, unless their fire was so effective that the ranks were broken and a break-through was possible. Variants of this were fire delivery by two or more successive troops followed by shock tactics, a body of heavy cavalry riding on the heels of the light pistol or petronel-armed troops, charging the line with sword and lance under cover of the smoke and confusion.

The function of the musketry and fire-armed foot soldiers was to protect the line of battle from these mounted firearm charges, obliging the cavalry to keep at a respectful range by directing a covering fire. The musketeers and matchlock men themselves were covered against the charge by the long pikes of the pikemen. In general the firearms had not yet come to be regarded by military commanders as the main weapon, and the theory of shock tactics with the *arme blanche* still dominated the tactical handling of infantry as well as horse. There was no change until Gustavus Adolphus of Sweden realised the value of fire tactics and the futility of the pike.

[1] Demmin, op. cit.

SCOTCH AND SPECIAL PISTOLS

1. Scotch pistol by Murdoch of Doune, *c.* 1780. The conventional ram's horn butt is replaced by a return to the all-metal tulip or bulb type. The stock is inlaid with silver and coarsely chased. (Mr. S. Haseltine's Collection.)

2. Italian flint lock, *c.* 1770. The type of 1700 endured relatively without change, and was not affected by the duelling pistol design, as in France and England.

3. Duelling pistol by Joseph Manton. Date, 1805. The very heavy octagonal barrel is inlaid with massive platinum, but there is no ornament or enrichment.

4. Curious long barrelled flint lock pistol by Bond. The barrel is 14 ins. long and the arm is closer to a shotgun pistol than a duelling arm, although of duelling bore and well sighted.

5. Typical all-steel Scotch pistol with ram's horn butt and pricker. The hammer indicates the lateness of the type. The specimen is probably subsequent to 1800.

6. Duelling pistol by Wogden and Barton, *c.* 1790. The butt is flattened on each side and the trigger is peculiarly short and stout.

7. Typical officers' military pistol by Nock, *c.* 1800. The design is the same as duelling pistols, but the bore is ·577 and the barrel only 7 ins. long. These arms could take the service musket ball.

8. Bow Street runners' pistol by Harding, *c.* 1820. These extremely rare little pistols are marked with the crown and a broad arrow. They are short barrelled pocket pieces with heavy round barrels of ·5 calibre.

9. Brass barrel box lock pistol with folding trigger. This specimen is rather larger than the usual pocket type and was issued to the Volunteers when the Napoleonic invasion threatened.

10. Scotch pistol by Will Allan, *c.* 1740. This piece shows the early type of hammer with pierced rear lobe. The lock has the external half-cock scear and a crude safety bolt.

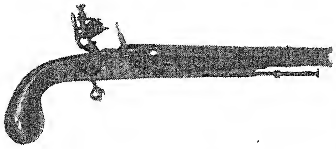
11. French pocket pistol, *c.* 1780. The shape of the butt is typical of French arms subsequent to 1775, and the graceful pillar trigger guard is also a typical French indication. (Mr. F. Russell's Collection.)

12. All-steel Scotch pistol by Campbell of Doune. This fine specimen is inlaid with silver ornament and has the pricker and trigger knobs of pierced silver. (Major H. Hall's Collection.)

13. Reverse of No. 12, showing the silver belt hook and escutcheon on the butt.

14. All-steel Italian horseman's pistol, *c.* 1700. This rare type has a hollow tubular steel butt made in one piece with the barrel. The lock work is external and the trigger action is also on the lock plate. (Major H. Hall's Collection.)

15. Dutch horseman's pistol by Jan Van Knoot, *c.* 1690. The side plate is pierced and chiselled steel, the butt of beautifully figured wood.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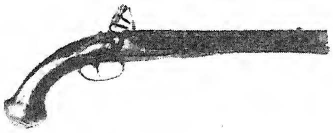
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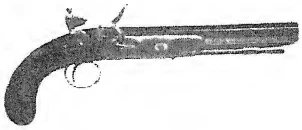
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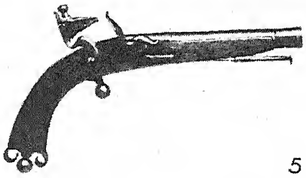
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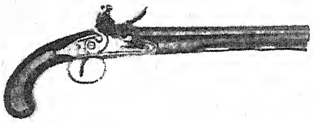
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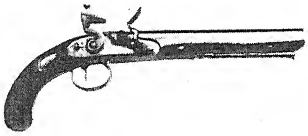
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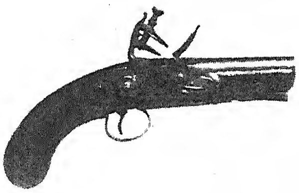
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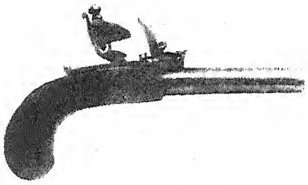
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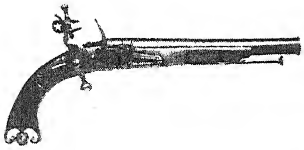
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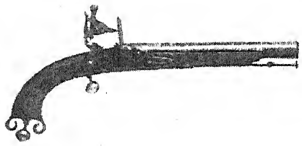
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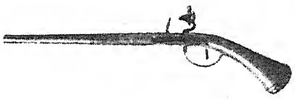
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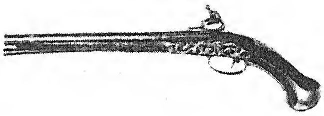
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CHAPTER III

THE 17TH CENTURY

THE 17th century is remarkable for the general development of the true flint lock and the eventual supersession of the pike by the bayonet carrying firearm. The last forty years of the century were also remarkable for some very interesting experimental arms and the standardisation of certain definite types of pistol. I have also found in this period the first mention of the purely automatic explosion operated principle. Arms on this principle were not previously known to have been thought of until the last decades of the 19th century.

The date of introduction of the flint lock has been attributed by most writers to 1630–1640, but it is not easy to find on what evidence they based their facts. A picture of Colonel Joyce, a Republican officer, with a flint lock pistol in his hand, was in Sir Samuel Meyrick's collection and appears to have been the earliest pictorial record of this type.[1] Demmin[2] states, "The flint lock gun was in all probability invented in France about 1640."

The special commission for the survey of armour, arms and equipment of the trained bands appointed by Charles I in 1631, fixes rates for "fire lock pistols furnished with a key," and "horseman's pistols furnished with snaphaunces." The former must of necessity have been wheel locks. The assumption that snaphaunce means true snaphaunce and not flint lock is not proven, and the illustrations in Cruso's *Instructions to the Cavallerie*, and other contemporary works, are usually from far earlier Dutch woodcuts. I have yet to see an English snaphaunce!

The arms trade in England had suffered a set-back, for though there were some thirty-seven gunsmiths in the Minories during the reign of Elizabeth in 1590, Henricke, a Dutchman, was the head of the craft and

[1] *British Field Sports*, Miles, p. 4. [2] Op. cit., p. 70.

King James I had granted a monopoly of gun making to Edward Nicholson, so that under restriction manufacture dwindled till in 1607 there were only five gunmakers, who petitioned Parliament for the removal of the oppressive monopoly.[1] Nevertheless, we learn from contemporary sources[2] that the roads were infested with footpads and robbers "almost all with pistols."

The accession of Charles I led to considerable reforms and in 1631 the rates of pay for repairs and new arms were fixed. In 1637 the Company of Gunmakers of London obtained their charter of incorporation. In 1620 Letters Patent were taken out in London by Arnold Rotsipen for "a new art, industrie, waye, or meanes of makeinge gonnes." A subsequent patent of his, 1635,[3] relates to a machine "to rifle, cutt out or screwe barells as wyde or as close or as deepe or as shallowe as shal be required." The general tone of the specification, however, suggests that Rotsipen was what we should call a mechanical engineer to-day rather than a working gunsmith. He seems to have had the idea of putting up a factory for mass production and stamping certain minor parts. He is customarily quoted as the first man to introduce rifling in England, but it is not certain that "rifling" meant more than boring. The reference to screwing is to the necessary breech plug thread rather than to any form of twist rifling.

The manufacture of Highland pistols had also evolved a flint lock type analogous to the Spanish lock, and there is also the fact that pocket pistols or "pops" had come into vogue. Neither wheel lock nor snaphaunce was well adapted for pocket use, although a few pocket-sized pieces of exquisite workmanship were made in both types. The indications are that small cannon barrelled pistols with rounded butts and side hammers, or else small Spanish lock pieces with wooden butts, independent side locks and short cannon barrels, represent the earliest common pocket pistols. Very early examples of these exist, but it is difficult to ascribe precise dates. I am inclined to think that they represent one of the very earliest 17th century types. Unfortunately neither names nor proof nor armourers' marks exist on many of the small pistols. Some bear the names of late 17th century makers and the type endured till the early part of the 18th. It is

[1] Ref. Pet. B.M. [2] Lansdown MS. 63.
[3] Pat. 44,162 and Pat. 711,635.

open to question if some of the small all steel Segallas or *écossais* box lock pieces marked with the name of an English maker and the word L o n d o n or L o n d i n i were actually of English make or earlier than the mid-18th century. They do not bear evidence of quite the same style of workmanship as purely English made arms of larger calibre of the same period, and were quite probably imported in the rough state from the Continent, probably the Liège area, and finished and retailed here. I have found them with spurious London proof marks and am inclined to think they were nominally what the French call *écossais* pistols built for the Continental market.

The London Gunmakers' Company initiated proofs when it was first incorporated in 1637,[1] but it is not clear whether private proofs or a trade proof-house common to the Company was used. It was not until a second charter granted in 1672 was obtained that the Company enjoyed powers which enabled them to enforce proof. They then became entitled to search for, prove and mark all manner of hand guns, great and small, dags and pistols, and every part thereof, whether made in London or the suburbs, or within ten miles thereof, or imported from foreign parts, or otherwise brought thither for sale.[2]

The proof marks of the Company are found on the barrels of many late 17th century pieces, and the name of the maker and the town of origin, London, is often found both on barrel and lock. The name London and the absence of the proof mark is, however, not an absolute guarantee that the arm was made prior to 1672, but is a point which must be considered in relation to the type and design of the individual piece.

In the same way arms made for the service and probably sold to the authorities at the Tower of London bear special proofs and viewers' marks. Such are the muskets made during the reigns of James II and William and Mary, which, if of service type, seldom carry the Gunmakers' Company's Proof. This exemption from the legal proof is enjoyed by service arms to-day. The earliest London proved pistols hide the mark under an ornament of the trigger guard. It was probably thought to be an eyesore.

[1] A crowned A was given as the mark. I have never yet found it on any firearm or found anyone who had seen it on any specimen.

[2] W. Greener, *The Gun and its Development*, p. 288, 9th ed.

FLINT LOCK PISTOLS

1. English flintlock pistol, *c.* 1780. The hammer has a spur of late type. The walnut stock is inlaid with piqué designs in silver wire and the escutcheon bears a crescent moon and seven stars. A symbol associated with Continental Freemasonry.

2. Sardinian pistol. (Mr. F Russell's Collection.) The butt is all metal of light brass decorated with crude moresque engraving. These arms are of special type peculiar to Sardinia. Date, *c.* 1700.

3. Turkoman or Cossack pistol. (Mr. F. Russell's Collection.) These are a specific type and have wood stocks covered with twin-grained leather. The knob trigger and ball butt show a traditional adherence to early design. The knobs are usually of ivory, but Cossack Service type pistols with wooden pommels are also found. Date uncertain as the type is still in use.

4. English holster pistol, *c.* 1750–1770. Butt inlaid piqué silver wire, and butt cap crowned with grotesque lion mask in heavy silver. Maker, Peele, Whitehaven.

5. Double-barrel English flint lock carriage pistol, *c.* 1800. This piece still retains the ball butt of the earlier cannon barrels, but the slide bolt which holds the barrels to the stock replacing the older pin fastening shows relatively late design.

6. An Italian flint lock holster pistol of *c.* 1750. The long barrel and graceful proportions of the 17th century design are still retained.

7. Late French under-and-over tap action double-barrelled pistol, *c.* 1780. The stock shows something of the Continental form known as "bird beaked."

8. Early four-barrelled brass tap action by Knubley. A side latch cuts off the right-hand pair of barrels, and in combination with the tap action each barrel can be fired separately.

9. A box lock pocket pistol with piqué inlaid wire stock and silver mask butt, date *c.* 1790. In this a late modification of the cannon barrel is revived. Maker, Archer, of Birmingham.

10. French Revolution model naval pistol. A reversion to the earlier type of lock on Queen Anne pistols. Brass lock body and butt cap, but steel butt strap on frame.

11. English officer's model service pistol, *c.* 1770. The pin fastening of the barrel is still retained, and the flat-sided butt inlaid with wire is typical of a short-lived fashion.

12. Blunderbuss or boarding pistol in gun-metal, *c.* 1770. Maker, Twigg, London. These box lock pistols were large substantial weapons made for house defence, carriage pistols and the last India market. The tradition that they were used for boarding parties is associated with the French marine rather than the British Navy.

13. Left-handed cannon barrel type pocket pistol by Nock. This is one of a pair, but left-handed locks are excessively rare. The hammers on this pair are not original, but replacements from a fowling piece. The use of left-handed locks was for convenience in carrying a pair of pistols in the belt.

14. Late under-and-over tap action double-barrelled pocket pistol. A common English type, *c.* 1800.

15. Silver mounted French pocket pistol, *c.* 1750. The side plate, escutcheon, trigger guard and butt cap are all of chased silver with medallions of Diana and hunting scenes.

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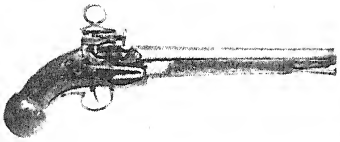

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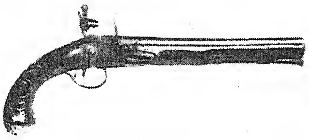

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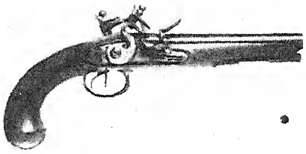

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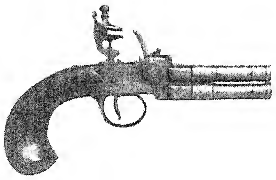

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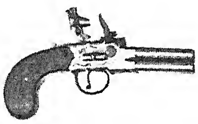

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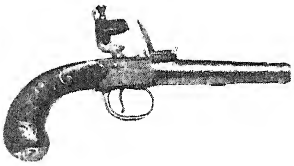

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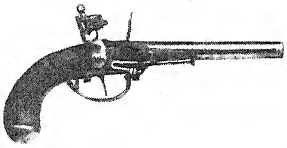

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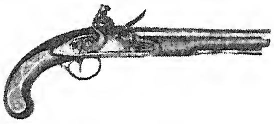

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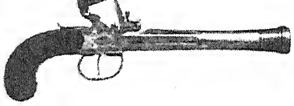

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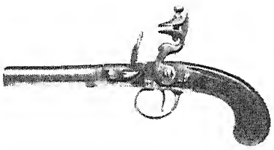

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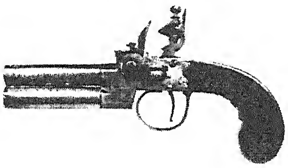

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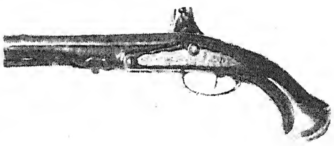

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The armourers' mark of the gunsmith or barrel maker was often stamped between the two marks of the Company's Proof.[1] It usually consists of the makers' initials. Despite the legal powers enjoyed by the Gunmakers' Company it is doubtful if early pieces were often seized and reproved. Newly imported foreign stock doubtless was, but I have never found any specimen which would suggest reproof except in the case of an 18th century Spanish barrel which had been reproved and retouched in England. Late 18th century Spanish and Austrian arms, such as Kuchenreuter pistols, were often relocked and restocked by London makers, but the barrels do not seem to have been re-proved with English proofs.

We find Shakespearean evidence that at the beginning of the century birding pieces and pistols were in common usage among well-to-do people. Sir John Falstaff, in the *Merry Wives of Windsor*, is unable to seek refuge in the chimney because Mrs. Ford and Mistress Page's husbands and friends discharge their " birding pieces " there when they return from a day's shooting. So too we find in the same play a reference to three of Master Ford's brothers " watching the door with pistols that none may issue forth."

The rifle, perhaps a rifled carbine, was used in 1631 by the troops of the Landgrave of Hesse, and was issued a few years later as an *arme de luxe* to the bodyguard troops of Louis XIII. It was not apparently thought much of either in England or in the Low Countries, and it is doubtful if the rifled weapon of the period showed great advantage over a well-made smooth bore. Many screw pistols have an apparently rifled muzzle, but this is usually simply to receive a squared key to unscrew them. Sometimes the grooves are true rifling, but seldom.[2]

In ammunition a considerable advance had been made, for powder was now grained or " corned " in place of being simply a finely ground loose mixture of mealed powder. The practice began fairly early in the last century,[3] but it is not until later than 1600 that the practice of the

[1] The crowned GP and V.

[2] The Indictment of John Chiesly, Laird of the Lands of Georgie and Darlie, for the murder of Sir George Lockhard of Carnwathm, 31st March, 1689, describes the crime as being committed with " a pocket rifald pistol." Quoted by William Roughhead in *The Riddle of the Ruthvens*, Edin., 1919, p. 70.

[3] Nic. Machiavelli, *The Arte of Warre. Transl.*, Peter Whitham, 1588, p. 27.

musquetier, carrying separate horns, one of powder and the other of priming serpentin powder, becomes general.[1]

The corning appears to have been done by passing cakes of pressed powder through rollers, then to mills, and sieving the result.[2] The effect of graining powder was to make it less hygroscopic, far easier to load and to apportion into cartridge charges, and also made it far quicker burning. The grained powder had, however, sufficient heat absorbing power to extinguish a spark from flint and steel before igniting itself. Smaller particles easier to inflame were necessary for priming, and the dust or powder of the material which passed through the finest sieve was gathered together for priming powder. It added to the complication of loading, but the gain in power due to the use of good grained powder was so important that its use could not long be neglected.

The powder of the period varied very much in efficiency, and contemporary works giving recipes for its manufacture vary very widely in the proportion of saltpetre, sulphur and charcoal to be incorporated. Adulteration appears to have been rife, and it is probable that variations in the strength of powder led musquetiers into serious errors of calculation in regard to the strength of their weapons. Burst guns were frequent, and it does not appear that the most dangerous cause of bursts, an obstruction in the barrel, however trivial, in front of the charge and separated from it by an air gap, was recognised till a hundred or more years later.

A good idea of the soldiers' views of the times are given in the following extract[3]: "Hee that lovyth the saftie of his owne person and delights in the goodness and bewtie of a peece, let him always make choice of one that is double breeched, and if it be possible, a myllan peece, for they be of tough and perfecte temper, light, square and big of breech, and very strong where the powder doth lie, and where the violent force of the fire does consist, and, notwithstanding, trimme at the ende. Our English peeces approache very nigh unto to them in goodnesse and bewty (theyr heavinesse onlie excepted) so that they be made on purpose, and not one of those common sale peeces with round barrels, whereunto a beaton (ex-

[1] Demmin claims 1452 as a German date for the practice of corning powder, but gives no authority.

[2] Hanzelet, *Recueil de plusieurs machines militaires*, 1620, p. 15.

[3] *Military Treatise*, 1619.

perienced) souldier will have a great respect, and rather choose to pay double money for a good peece then to spare his purse and endanger himselfe."

The same author continues on powder: "One of the greatest helpes consist in the pouther and matche: for a souldier should ever buy his pouther sharpe in taste (a good rule of thumb method of estimating the nitre content!), well incorporate with salt petre, and not full of coale-duste (probably used as an adulterant and not easy to distinguish from powder). Let him accustome to drie his powder, if he can, in the sunne, just sprinkling it over with *aquae vitae* or strong claret wine. (There is no reason for this, but it was a trick much believed in during the period. The Italians were very keen on it.) Let him make his tutch powder being finely sarsed and sifted with quick pale, which is to be bought at the powder makers or apothecaries (probably touchwood, i.e. deadwood, soaked in dilute nitre solution and dried. It was used for tinder boxes), and let his match be boyled in ashes lie and powder, that it may both burne well, carry a long cole, and that it will not fall off with the touch of his finger. This preparation will, at the first touch, give fire, and procure a violent, speedy, and thundering discharge. Some use brimstone, finely powdered, in their tutch hole pouther, but that furs and stops up your breech and tutch hole.

"The bullet of a souldier's peece must be of a just bignesse with the mouth of the same, so that falling in smoothly, it drives down and close up the mouth of the pouder. If the stocke of the peece be crooked, he ought to place the end just before the righte papp, if long and straight, as the Spaniards use them, then upon the point of his right shoulder, using a stately upright pace in discharge. The musquet is to be used in respect, it carries a double bullet and is much more weightie. The souldier uses a staffe breast high, in the one end a pike to pitch on the ground, and in the other an iron forke to reste his peece upon, and a hole a little beneath the same in the staffe; whereunto he doth add a string, which tied and wrapped about his wrest, yealdes him comodity to train his forke or staffe after him, whilst he in skirmish doth charge his musquet afresh with pouder and bullet."

The musket proper, that is to say, the heavy shoulder arm needing a rest, was declining about this time. The rest was always an encumbrance,

ORNATE WHEEL LOCK GUN

Ornate wheel-lock gun with peculiar external connection of wheel and spring. Arms of this type and French origin occur in one or two collections. The specimen from which the original drawing was made is unidentified, although the bulk of the drawings represent arms originally in the Meyrick and Spitzer Collections, now in the Wallace Collection.

but they were sometimes borne not only by the infantry but by the cavalry. Sir John Smith relates[1]: "I myself have seen mosquetteers on horseback in two divers armies, and that in this sorte, I have seen squadrons of lancers have in one only wing ten or twelve musquetiers, in one ranke, and sometimes in two wings, upon cold and quiet horses, onely to carry them a marche, or trott with squadron of launces, and the mosquettiers were armed with half breasts or cuyrats (cuirasses) with long reasts of steele strong and firmly set into them, to put backward over their shoulders, and when they list to pull them forwardes, for the mosquetiers to lay their mosquets upon when they woulde discharge them. Even such Sir William Pelham did cause to be made at the Mynories, by one Heindricke a Dutchman, before his last going over to the Low Countries, which invention came not of his own devyce, but from that he had seen the like used by certain musquetiers on horseback in the wars of the Emperor Charles V."

This note albeit about "mosquettes" may indicate something of the early history of the petronel, poitrinel or breast fired large bore cavalry weapon which was claimed by some authorities to be heavier than and of larger calibre than an arquebus. Otherwise it does not seem practical, for the centre of gravity of a long musket would still be far beyond any point of support a lever arm fixed to the corselet could normally afford.

The attempt to use muskets on horseback doubtless brought about the reduction in barrel length which led to the petronel, which was of full musket bore, heavier than an arquebus and shorter. This is turn bred the dragon, whence we get the name Dragoons. "These dragons are short peeces, of sixteen inches the barell and full musquet bore, with firelocks or snaphances."[2] The "dragon" is fitted "with an iron work to be carried on a belt of leather, which is buckled over the right shoulder and under the left arm; having a turnell of iron with a ring through which the piece runneth up and downe."

A short piece slung in this manner could be reloaded without dismounting. It has escaped the notice of some writers that a muzzle loading piece for mounted use had of necessity to be of such length that it could be reloaded without dismounting. In fact, the necessity for dismounting was

[1] Sir John Smith's *Confutation of Captain Berwick*, MSS. No. 4685, B.M.

[2] Markham, *Souldiers' Accidence*, 1648, p. 37.

the probable reason why some of these early troops were classed as that unhappy hybrid, mounted infantry.

Why the large calibre of musket bore, twelve loose fitting or ten tightly fitting balls to the pound, was still retained, is rather a puzzle. Probably it was because the sensible tactics of teaching your men to shoot at the horses and not bother much about the men was fully understood at the period. A smaller ball might penetrate a cuirass and have special advantages, but the great fat ball of soft lead, ·8 ins. in diameter, would have mass enough to bring down a horse, where a smaller projectile of greater velocity would lack stopping power. Incidentally it would not unlikely knock a man out of his saddle even if it did not penetrate his cuirass.

This large bore, rather larger than the familiar nominal 12 bore sporting gun cartridge of to-day, was retained by us until the 19th century. The Dutch preferred even larger bores (about eight balls to the pound), but other nations reduced their calibre (and the efficiency of their arms) to 20 bore.

The need of the times was for reliable and sure fire, not particularly decorative pieces of essential practical value. The fussy ivory and antler inlaid work very largely disappears, and art is represented by some of the very finest chased and chiselled steel work the world is ever likely to see. A grace of line and a harmony of proportion supersedes the clumsiness and grotesqueness of the 16th century pieces. The hammer or cock is no longer a squared steel gargoyle, but a graceful and practical piece of beautifully curved and rounded steel. Even the plainest pieces show this departure from the massive and heavy Gothic treatment of the previous century. The best work of the Italian armourers of the middle and late 17th century represents perhaps the best and most artistic decorative craftsmanship ever applied to firearms. Brescia and Milan, and after them Paris and Spain, entirely outrank the heavy-handed Augsburg and contemporary German work. The German steel, though, was excellent, and barrels from Solingen and Augsburg were still held in respect, though more often than not mounted with locks and stocks in the country to which they were exported. The sudden falling off in German material is particularly noticeable, and is conceivably due to the general upset caused by the Thirty Years' War. It is also undoubtedly a fact that German barrels of heavy and complicated

wheel lock pieces were converted to plain and useful match locks or otherwise remounted for useful purposes. (The Henry VIII breech loading arquebuses were undoubtedly wheel locks to begin with, but were at some time later altered to match locks.) The original locks had probably gone out of order, for it is noticeable that crystallisation of the metal affects many of these early guns very badly. Parts under stress lose the strength given them in the forging and snap at the slightest pressure. The hammers and scears seem the most affected and the springs and the delicate chain work which one would deem more likely to go seem to retain their temper far better than the hammered limbs. Metallurgical examination seems to afford ground for the supposition that the blanks for the scears and hammers were often pressed or stamped rather than forged. In later arms the snapping across the neck of the cock or hammer often reveals a comparatively unworked structure, while the portions which have been hammer forged are closer in texture and show no signs of deterioration.

The metal of firearms was customarily called iron, but is in reality closer to mild steel than to the wrought or malleable irons.

The steel used in Spanish pieces is often markedly superior to any contemporary metal and takes and retains a very remarkable polish. The Italian steel is less hard and works well, but is remarkably tenacious. The English steel is better than most of the Continental metal and takes and retains a higher degree of polish, but it contained many impurities and imported Swedish iron was often preferred. It was almost entirely Monmouthshire iron, charcoal-melted with pig in the Forest of Dean and later refined into bars. The Staffordshire and Midland iron, called " cold shore " iron, was coal-melted, and was known as a short soft iron, mainly used for nail making and inferior purposes.[1] In general arms were made only in London, though Bromsgrove, near Birmingham, and Norwich are mentioned by Nathaniel Nye, the Commonwealth gunner. He especially states that snaphaunces were made at Norwich in 1585 by one Henry Radoe.[2] The needs of the civil war probably stimulated local production as well as imports from Holland and Flanders.

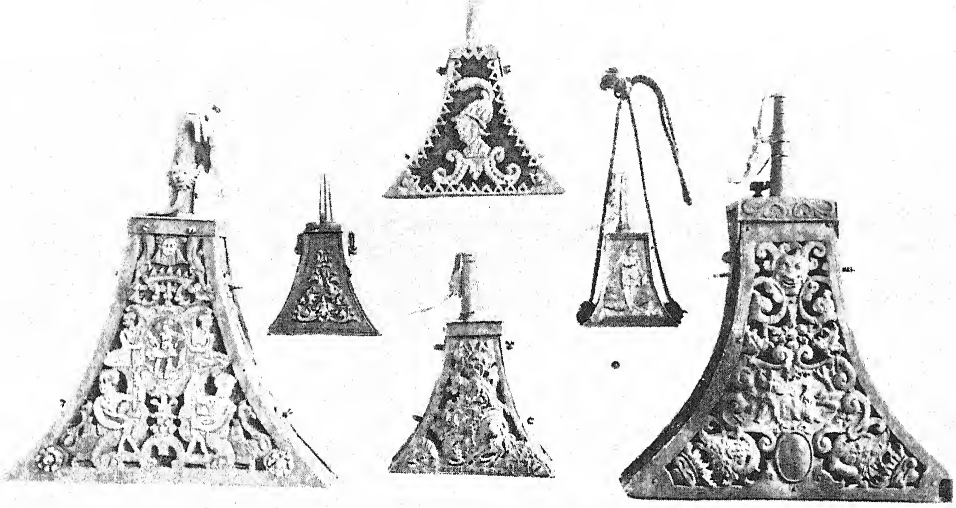
Prices too must have been relatively low, for we learn that as early as

[1] Yarranton, 1667.

[2] Norwich was a noted centre for smuggling from the Lowlands, and a local manufactuer may have meant nothing more than a convenient cover for illicit importation.

POWDER AND PRIMING FLASKS

1. Typical pierced metal musqueteer's powder and priming flasks. The metal casing is laid over velvet on a wood or metal box foundation. In general this form is essentially military rather than sporting, 17th century. (John Ball Collection.)
2. Antler and bone powder flasks, 16th and 17th century. The central round type of priming flask possesses an unscrewable centre or circular panel for recharging. In some flasks this covers a small sundial, a string from the edge of the disc to the ring of the recess forming the style or gnomon of the dial. (John Ball Collection.)



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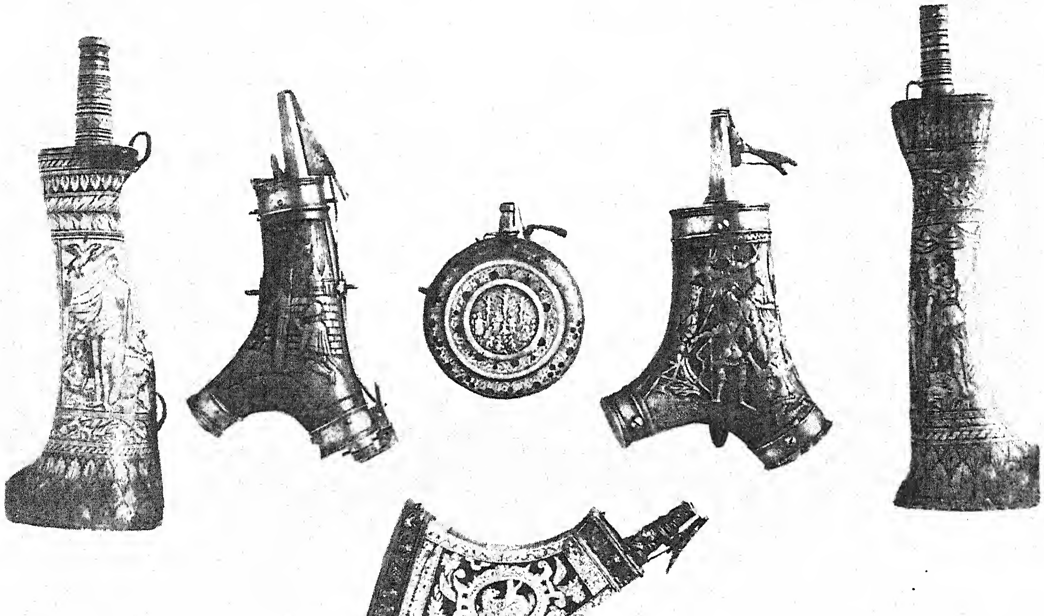

2

the reign of James I pistols were commonly carried by footpads and robbers who infested the roads in gangs armed with "chacing staves," that is 12 ft. steel-shod poles, bows and arrows or with guns—" and almost all with pistols."[1]

Shooting at the papingo or popinjay was a popular sport, and there was a close similarity in the training of train bands for town or city defence with the similar practices in vogue in the Low Countries.[2]

The introduction of coaches and vehicles for road travel led to the use of blunderbusses and case pistols, particularly for road defence. The blunderbuss, sometimes called *springol* or *springal*, from Spanish *espingole*, does not seem to have been well known prior to the Civil War. It is noteworthy that the Rye House plotters in 1685 recognised its value and ordered from Daft or Dast (the long s is confusing), the gunsmith of Shire Lane, thirty carbines, thirty cases (i.e. pairs) of pistols and ten blunderbusses. The earlier blunderbusses were often fitted with wheel locks taken from even earlier weapons. As a blunderbuss was essentially not an arm of precision an old wheel lock with a stiff trigger pull was adequate to the needs of the piece.

There were divided opinions concerning the relative values of wheel locks and snaphaunce or battery locks. One school held that the wheel lock was far more certain to fire even if slower to cock and more cumbrous to handle. The other maintained that a snaphaunce could be reprimed and recocked far more quickly than a wheel lock could be respanned and was no more uncertain to give fire. The soldiery and the military leaders of the time swore by the match lock as being the only type reliable for the rigours of campaigning and the rough handling of soldiers. Except in wet weather it was reliable!

In France and England the preference always seems to have been for the snaphaunce or flint lock rather than the German-favoured wheel lock. As early as 1608 the guns and carbines of English workmanship, as fine weapons as any in the world, sent by James I to Philip III of Spain, were of the true snaphaunce type.

Thirty years later at the outbreak of Charles I's ill-fated Civil War, the cavaliers were armed with snaphaunces and flint locks and the beautiful slender Italian type of wheel lock. These latter pieces were of more

[1] Lansdowne MS. No. 63. [2] *Fraternité de St. Antoine*, Ghent.

refined quality than the English made ones, but they were no better as regards their efficiency. These plain English pieces, made for war rather than sale, seldom bear armourers' marks or makers' names, and plain service arms were often imported in a rough or "white" state from the Lowlands. The gunsmiths had bulk orders to fill, and these were not times to dally with fine chasing work. The plainness of these pieces has led to their great scarcity, and plain English Civil War pistols with simple steel pommels and crude trigger bows are far scarcer than delicately worked pieces of foreign origin treasured down the generations for their beauty of ornament.

We get a good idea of these relatively simple arms from the Commission appointed by Charles I in 1631[1] to settle the rates, prices and standards of armament of the trained bands. It was decreed that the gunmakers should be prepared to deliver 1500 muskets and bastard muskets (calivers) and small shot (carbines and pistols). A committee of leading gunmakers was appointed to send delegates to overhaul the provincial armouries and stocks of arms held at the common charge of every "cittie, towne or village" and "new make, alter, amend, dress, repair, prove and stampe (as need shall require) all or any of the said armour, gunnes, pikes and bandaliers." The stamp was to be "A and Crown," being the hallmark of the worshipful company of workmen armourers of London.[2] In addition two other marks, to prevent one county borrowing arms of another on purpose to deceive this unwelcome survey, were licensed. These were to be county and place marks, but their nature is left unspecified in the warrant.

The Gunmaker's Rate

	£	s.	d.
For a new musket with mould worm and scourer	o	xv	vi
For new walnutt tree stock for a musket plated at the butt and with iron	o	ii	vi
For a musket stock of breech plated at the butt end with iron	o	i	viii
For a match tricker lock complete	o	i	o
For a whole worke consisting of the pan, the cover of the pan, the scutchion and the screw pynn	o	i	o
For a stick worm, sockett, scowrer and bone . . .	o	i	i

[1] *Rymer*, Tome XIX. [2] No firearm bearing this mark appears to be known to-day.

	£	s.	d.
For a handle or guard of a tricker	o	o	vi
For a new cock fitted	o	o	viii
For a new breech	o	i	o
For furnishing and setting a tricker lock in place of a scear lock with a handle tricker and tricke primers	o	ii	vi
For a new touchole screwed	o	o	x
For a new barrell of a musket, only forged and bored four foote in length, the bore according to the bullet of ten in the pound standing, and twelve rowleing	o	viii	o
For making clean and new russetting of a musket . .	o	o	iiii
For a musket rest	o	o	x
For making a square fyled musquet white	o	i	viii
For the yearely dressing and keepeing clean a musket that needs not new russetting with the furniture ordered. . .	o	o	x
For powder and shot for proving every musket . . .	o	o	o
For stamping every musket proved and allowed . . .	o	o	o
For a new bandalier with twelve charges, a prymer, a pryming wire, a bullet bag, under strap or belt of two inches in breadth	o	ii	vi
For a pair of firelock pistols, furnished with a key, mould, scourer, worm, flash and cases of leather of length and boar according to the allowances of the counsel of war . .	iii	o	o
For a pair of horsemans pistols furnished with snaphances, moulds, worms, scourer, flash, a charger and cases . .	ii	o	o
For a harquebuse with a firelock and belte swivell, flash key, double worme and scourer	i	xvi	o
For a carabine with a snaphance, belt, swivell and flask as aforesaid	i	o	o

The use of beechwood as well as walnut is noticeable in pistols of the period. These and carbines were often black varnished or japanned. The " new touch hold screwed " is evidently a repair method for conserving as serviceable arms so badly gas cut or corroded at the vent as to waste too much energy. The terms of bullets " ten standing and tweleve roweleing " appear to be major and minor limit gauges. The barrel must not let a 10 bore ball drop down, but must admit a 12 bore easily. A reduction

TYPES AND ORNAMENT

1. Duelling pistol by Boutet of Versailles, armourer to Louis XVI, to the Republic and to Napoleon I. The lines and decoration are typical of the best French arms of the late 18th century.
2. Holster pistol with folding bayonet by Prosser of Charing Cross. These were made for the Volunteers of 1792, when Napoleonic invasion was feared. The pistol shows a curious similarity to the French type and has the pan cover spring of the cannon barrel pistol popular a century earlier.
3. Late Scotch all-steel pistol converted to percussion.
4. Pocket pistol, *c.* 1790, with swan necked hammer and folding bayonet. The stock inlaid with piqué silver design.
5. Flint lock military type Scotch pistol of 1740, with kidney shaped gunmetal butt.
6. Late percussion Scotch pistol, with wrought iron butt and conventional trigger. These were used as decoration with Highland costume after the Walter Scott revival.
7. The earliest type of true flint lock. In this lock the hammer is secured from within the lock plate as in the snaphaunce. The hammer is of archaic type and the trigger guard peculiar. The date is in the first half of the 17th century.
8. Silver medallion decoration on steel ball butt typical of Continental arms.
9. The pierced scrollwork side nail plate of a holster pistol, *c.* 1710.
10. Finial of trigger guard on a silver mounted French pistol, *c.* 1750.
11. Bottom, trigger guard ornament of English holster pistol, *c.* 1730. Centre, acorn finial ornament, *c.* 1745, possibly Jacobite symbolism. Top, pineapple trigger guard finial, late 18th century.
12. Silver grotesque lion butt mark on English screw cannon barrel pistols of late 17th century.
13. Reverse of No. 1.
14. Chest lock combined with pistol. This rare and curious device is of Spanish design and is so devised that anyone tampering with the lock receives the discharge of the pistol. (Mr. S. Haseltine's Collection.)
15. Reverse of No. 3, showing the conventional belt or sash hook. This was needed to secure the pistols across the plaid or sword baldrick. It is well shown in Raeburn's picture of the MacNab.

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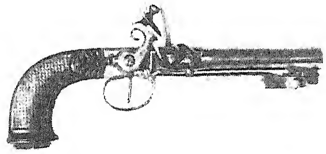

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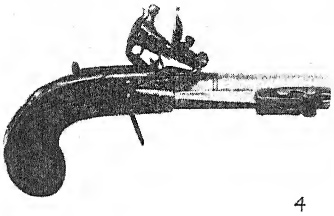

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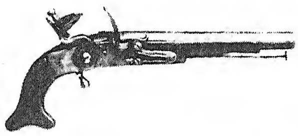

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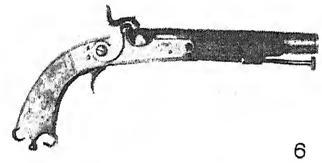

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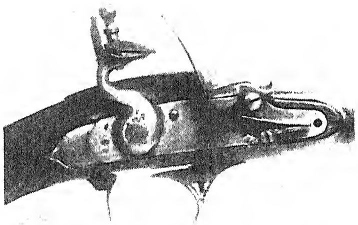

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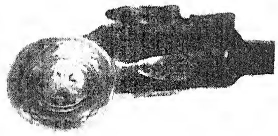

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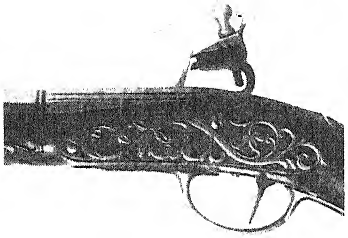

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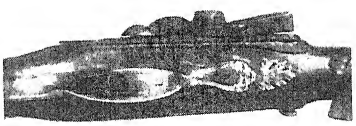

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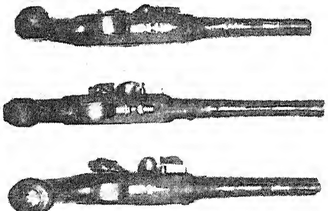

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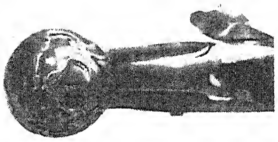

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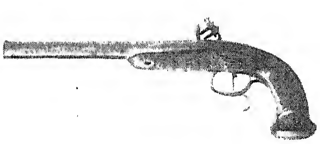

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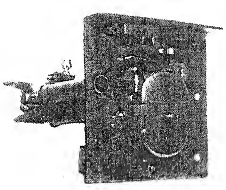

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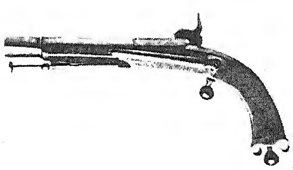

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of bore took place during the Civil War, for at the Restoration many muskets of 14 bore were in use. Pistols too had been reduced in length, and a statute of Charles II again prescribed a length of 14 ins. as a minimum. Prior to the Civil War we find them specified as part of a cavalryman's equipment: "He must have two cases (holsters) with good fire lock pistols hanging at the saddle. The barrell of eighteen inches and a bore of twenty bullets to the pound."[1] The word firelock is usually taken to mean wheel lock at this period, and snaphaunces are usually specified as such. The plates of Cruso's *Militaire Instruction for the Cavallerie* show exercises with both wheel locks and snaphaunce pistols, but the blocks are probably from an earlier Dutch source.

The older Continental authorities, such as Rodolphe Schmidt,[2] do not admit the existence of either Spanish or "Chenappan," i.e. snaphaunce, locks prior to 1635. Even as late as 1885 the curator of the Musée Royale, Bruxelles, is found suggesting that all evidence for a prior date to 1635 depends upon the one piece dated 1598, cited by Demmim as in the Museum of Dresden. There is now ample evidence for 16th century snaphaunces, and I personally believe that flint locks of the Spanish type or pyrites locks akin to the first flint lock were used on small pistols prior to 1603. We find in the Hengrave Inventory of 1603[3] "two snaphances and two little pocket dagges." These pocket dags may have been wheel locks, but it is improbable. The wheel lock mechanism even in its best and latest form is singularly ill-adapted to the pocket. The Spanish or miquelet lock, on the other hand, is quite suitable for pocket usage and many pocket pieces exist. These are not dated and seldom even approximately datable, for they were not as a rule first-class pieces signed by master craftsmen, but simpler and cheaper sale pieces. The Spanish were markedly conservative in design, and squat cannon barrelled pieces very little altered from the type of 1600 were made even later than 1700. It is always a possibility, though that as we nowadays pay attention to and list armourers' marks, a very early pocket pistol may turn up which will help to establish the dates of these early small pieces. In any case, as there were large size Spanish locks from 1550 onward it seems ridiculous to suggest that there were no small ones.

[1] Captain Cruso, *Militaire Instruction for the Cavallerie*, 1632.

[2] Rodolphe Schmidt, *Armes a Feu Portaif.* [3] *Ibid.*, p. 30.

From the mechanical point of view the change from Spanish lock to true flint lock is not too easy to determine. The reason is that whereas in the true Spanish lock the mainspring is external to the lock plate and the hammer is pivoted externally thereon, in the true flint lock the mainspring is inside and so is the tumbler of the hammer and the scear. Unfortunately the intermediate pyrites lock shows precisely the same mechanical structure, except that the scears penetrate the lock plate and engage the external hammer. This does not disappear with the evolution of the normal flint lock, but it is maintained in many Scotch pistols, and in Spanish pistols of the first quality made as late as 1790.

In the earliest known flint locks the cock or hammer is screwed on to the tumbler from inside the lock plate and has no external screw.

The only mechanical feature which appears to distinguish the normal or standard flint lock of settled design from preceding types is the "bridle," a plate of iron serving as a second bearing for the tumbler. This appears about 1645[1] and marks a considerable mechanical advance on the earlier types where the lock plate alone served as bearing. Some of the Italian snaphaunces later than this date also apply the bridle as an element in the lock work, but it is distinctively a late sign for the snaphaunce type of lock. It does not occur in the earlier Scotch flint locks, but is adopted in their models of about 1670, and it is not found in the dog lock.

It is also worth noticing that in many of the early pyrites locks no provision is made for absorbing the shock of the fall of the hammer. It is allowed to come down direct on to the flat abutment of the pan. This must have tended to break off hammers short, for in the snaphaunces of the early 1590–1620 type we find an improvement. A cheek piece or plate of metal is fixed on the outside of the lock plate between hammer and pan so that it meets not the jaws of the hammer as in the pyrites lock, but the breast of the hammer relatively near to its axis. This reduces the leverage and prevents the hammer being snapped off by a direct fall on to the breast of the pan. This same plate is noticeable in early flint locks of 1645.

In many of the Italian made versions of the ordinary Spanish lock the external lock spring acts on the *toe* of the hammer, forcing it down rather than as in the true Spanish model acting on the *heel* of the hammer and

[1] Schmidt, op. cit., p. 31.

forcing it up. In the Spanish pieces the stout lower jaw of the heavy short hammer is allowed to fall on the pan breast, but in the Italian models a projection on the lower surface of the toe of the hammer is stopped by the external bridle or bracket carrying the hammer, and the jaws of the hammer do not touch the pan breast at all.

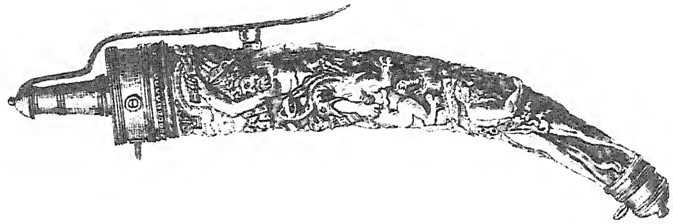
Another interesting lock variation is the type of combined match and flint lock known as a "Vauban lock," as it was supposed to be the invention of Marshal Vauban in 1692. Specimens bearing dates prior to 1689, the end of the reign of James II, are in the Tower.

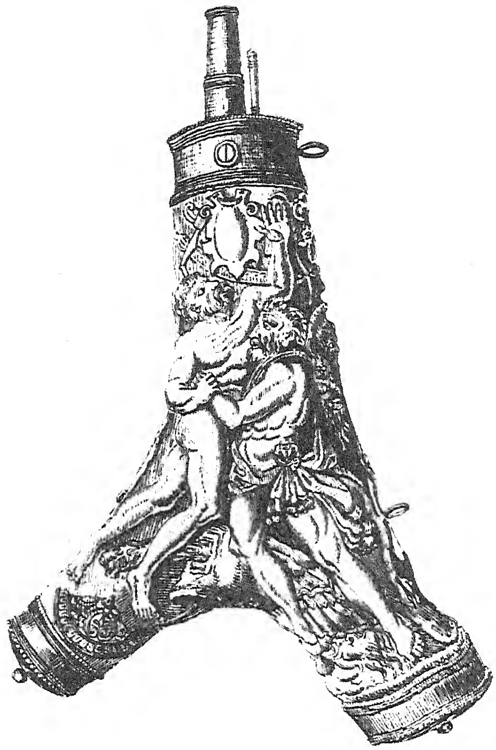
A contemporary type is the "dog lock" in which a dog or catch engaging a notch in the back of the hammer is pivoted on the exterior of the plate. These serve as a peculiarly safe form of half-cock detent and were probably designed to obviate the danger of accidental discharge when carrying primed arms. The earlier ones date from about 1640 and are not uncommon on early Tower muskets up to 1690. Modifications of the dog lock appear on Scotch pistol locks and a few sporting arms of the same period, and it appears to have lapsed or gone out of fashion even before the turn of the century. The dog lock is becoming extremely rare, and it is seldom found in other than very plain form. The internal structure shows a peculiar arrangement of the scear which intercepts notches on the tumbler laterally. That is to say it engages them just as the scear of a wheel lock projects into a hole in the wheel on the scear of a Spanish lock holds up the base spur of the hammer. These locks have had a Dutch origin attributed to them, but the system is very similar to that employed in some early Scotch pistols. One or two specimens marked W.R. (William of Orange) occur in the Tower Armouries and may owe the Dutch association to this. It is, however, possible that they were marked when a re-survey of the arms of the army was ordered and William completed the change over from match locks to flint locks for all troops.

Dog locks occur not only on muskets, but on cavalry pistols of rare and early type and occasionally on smaller holster pistols of crude type. They are, however, not simply ordinary flint locks with a dog catch, but represent a definite mechanism, and a specific type of lock. The dog lock is really an early idea of a half cock notch and is found on the early Moorish locks. Its importation from Scotland is probably from Spanish and Moorish sources and dates from the earliest years of the 17th century.

POWDER FLASKS

1. Ivory powder flask, polished and carved in relief with the first and second labours of Hercules. Italian, *c.* 1560. The piece is probably No. 971 in the Wallace Collection, previously in the Spitzer Collection.
2. Powder flask in staghorn. Italian, 1560–1580. Carved design of Hercules wrestling with Antaens. This piece is probably No. 964 in the Wallace Collection and was previously in the Spitzer Collection.





The 17th century is also noticeable for the quick development of the true shoulder stocked fusil or harquebus. For the early part of the century the word musket meant the heavy matchlock fired from a rest. The use of the rest went out about 1640, but the word musket was retained and foot arquebusiers and true musketeers alike were termed musketeers. About this time the word *fusil* appears, probably from the Italian *fucile*, a flint, but through the French corruption spelt *fusil*. It soon came to be used as a word distinguishing flint lock from wheel lock arms and was apparently applied both to light sporting pieces and flint lock muskets which were definitely fired from the shoulder with the cheek laid down to the butt,[1] " especially by couching the cheek you can take better aim with the *fusil*, yet it often misses fire from the use of the flint."

The earlier snaphaunces had a curious upturned stock rather like the reversed curve of a modern stock, while the short stocked arquebuses were often fired without being butted to breast or shoulder at all. The point appears to have been missed by previous writers, but this I am inclined to believe was due as much to the eccentric puffed sleeves and difficulties of costume as anything. Further, a man in a leather jack or plate cuirass and pauldrons was limited in many ways and it must have necessarily involved peculiarities of stock which were practical at the time, but have since become impractical owing to the changes of equipment and costume. The recoil was not improbably absorbed by taking the kick on either cuirass or padded jerkin.

The curved or " Scotch " type of snaphaunce stock was soon superseded by a very clublike, comparatively straight and specially thick sectioned Italian type with a rounded butt, which is often found on early pieces of Lazaro Comminaso the elder. It appears to cover the period 1640 to 1670 and progresses slowly to the ordinary true gun stock as we know it to-day. The comb, fine grip and curved heel plate of standard modern type are all found on the best arms of 1660–1680, and on Continental pieces the cheek piece which was introduced even on short stocked arms begins to assume the exaggerated form which endured till 1800 and can still be found in a less accentuated style in the modern Continental sporting arms of to-day.

The period from 1660, the Restoration of Charles II to 1685 is absorb-

[1] De Gaya, *Traité des Armes*, Paris, 1688.

ingly interesting. There was a general renaissance of interest in applied science and natural philosophy. His Majesty King Charles II was a great patron of the Royal Society, and Prince Rupert and Lord Moray were very actively interested in improvements in powder and firearms.

The predominant structural feature on which much of the inventive work of the period is founded is what is called by contemporary writers "the common screw pistols." These weapons represent an entirely distinct and, so far as can be learnt, purely English style. The date of their introduction is certainly prior to 1660, as the Patent granted to Edward, Marquis of Worcester,[1] in 1661 is: "an invencon to make carteyne guns or pistolls which in the tenthe part of one minute of an houre may with a flask contrived to that purpose, be recharged the fourth part of one turn of the barell, which remaines fixt, fastening it as forceably and effectually as a dozen thrids of any screw which in the ordinary and usual way require as many turnes." No specification was enrolled, but it is clear that in essence the patent related to a gun or pistol with a surrounding sleeve over the breech, a quarter turn of this sleeve would expose a loading hole in the barrel proper and a flask arranged to drop in alternate balls and powder charges would furnish a quick loading apparatus. Arms of this type and of this period are known. In some cases the sleeve unscrews along the barrel, in others the barrel itself is rotatable.

The curious point is that we are without accurate knowledge of when the screw or cannon barrel pistols came in, but it was probably prior to 1640. These consist of a stout cylindrical barrel turned at the mouth with rings like the muzzle of a cannon. This barrel has a slight projection on its lower surface, so that a cylindrical key fitted with a slot to engage the projection can be used to screw the barrel to the breech. The breech consists of a long and thick chamber of much smaller internal diameter than the barrel. The mouth is capped to receive a ball and the "lead" or cone where the ball is placed at the rear of the barrel is of larger diameter than the bore of the barrel itself. *These arms are therefore essentially breech rather than muzzle loaders* and are seldom fitted with ramrods or ramrod pipes for holding ramrods. One might be justified in saying never rather than seldom, for I only know of two pieces with ramrods, and both these are late conversions of earlier arms.

[1] No. 131.

The breech chamber forging is continued on the right-hand side to form a lock plate and the lower surface is carried on to make a curved trap or tang which supports the wooden stock. There is no opposite metal side plate as in the later box lock, and the cock or hammer is at the side, *not central*, and not above the hand and in the line of sight as in pocket pistols. Inside the lock a separate plate screwed to the bottom plate and of distinctly different type to the normal " bridle " serves as a pivot block for the left end of the tumbler spindle. In earlier specimens a forward extension of the trigger guard often covers the marks of the gunmaker's proof.

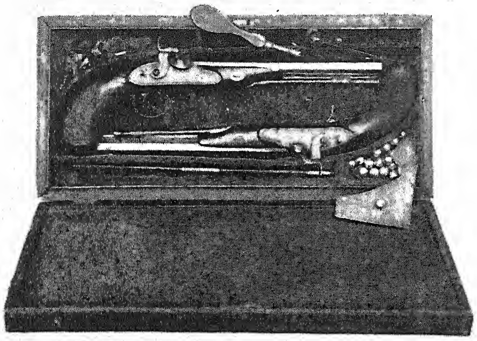
This cannon barrel type of pistol with an integral side lock was later superseded by a rather rare type of pistol employing the cannon barrel in conjunction with an ordinary or normal flint lock held by side pins. The barrel in this latter type is secured by a top extension or tang and a screw passing through the wood of the stock from the under surface in front of the trigger guard to engage in a screwed hole in the lower surface of the chamber breech.

The wooden fore-ends of these pistols are cut off short and often squarely at the junction of screw barrel and the chambered breech. They have no ramrods or ramrod pipes. In a previous work (*The Book of the Pistol*, 1916) I was inclined to look on them as an early 18th century transitional stage but I have since found that among the saddlery, swords and pistols of Charles I, left at Wistow Hall, Leicestershire, by the King, who slept there the night before Naseby, 1645, is one of these second stage development cannon barrel pistols, with the typical short wooden fore-end and screw breech. The pommel is of typical pistol type, with long curved reinforcing spurs curving up towards the breech, common on early snaphaunces.

The majority of these ramrodless screw and cannon barrelled pistols belong to the later decades of the 17th century and have silver lion or grotesque butt masks and silver mounts on dark walnut stocks, and are known as Queen Anne cannon barrels. They extended into the 18th century and changed slowly into the ordinary box lock form. They were a favoured type of early side-by-side or under-and-over double barrel pistol with tap action, but plain or variated they are still something of a mystery, for they apparently evolved out of no preceding type and early specimens of Continental manufacture are not known. The nomenclature of locks was

LATE PERCUSSION PISTOLS

1. A case of English duelling pistols, *c.* 1830. The accessories comprise bullet mould, nipple key, cleaning rods, scourer, pricker, wad punch and balls.
2. French duelling pistol case, *c.* 1850. In addition to the usual fitments, Continental cases usually contain an ebony mallet for hammering down the ball in its patch.
3. A pair of pistols of *c.* 1720 by Lazarino Comminazo which have been converted to percussion at a date at least a hundred years later.
4. Flint lock duelling pistol converted to percussion and fitted with hair trigger. Lower piece, a Nock percussion duelling pistol. These arms have a special chamber breech which is sometimes mistaken for a conversion.
5. Back action lock large bore pocket pistol by Egg. This arm is twelve bore and is a type which later yielded the familiar Derringer.
6. English waistcoat pocket pistol, *c.* 1850. This marks the maximum economy of material and was light yet fired a relatively heavy ball.
7. English pocket or house pistol, *c.* 1855, incorporating a stirrup ramrod.
8. Common pocket pistol with barrel and action in one forging.
9. Interior of late percussion lock for a hair trigger pistol. On the tumbler can be seen the diamond-headed "detent" which prevented accidental engagement of the half-cock notch by the scear nose.
10. Late under and over double-barrelled percussion pocket pistol with stirrup ramrod and belt hook, *c.* 1845.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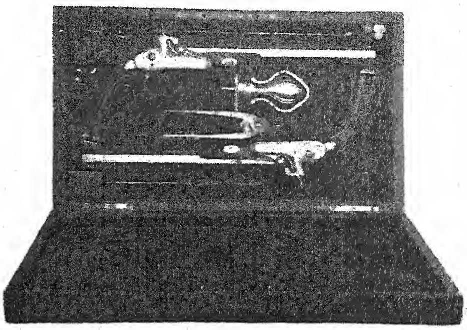
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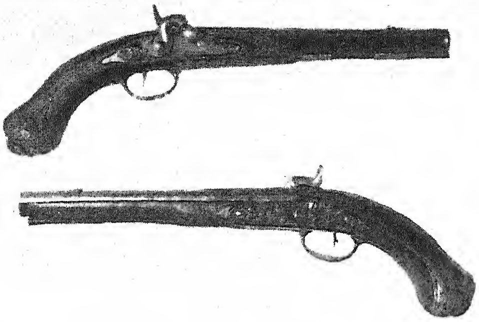
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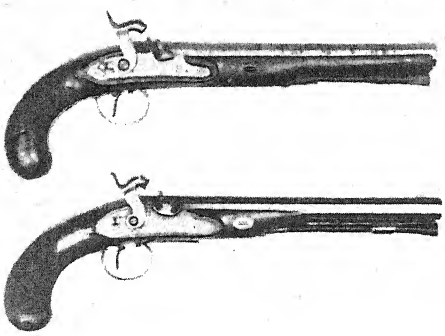
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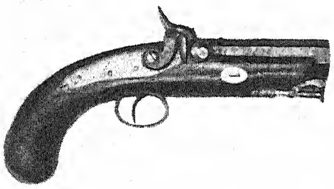
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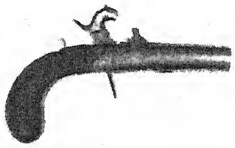
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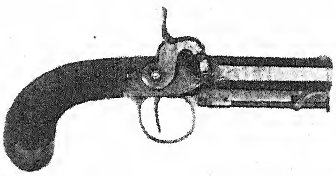
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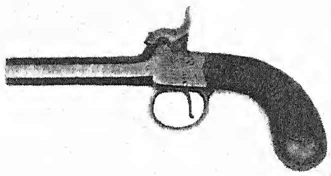
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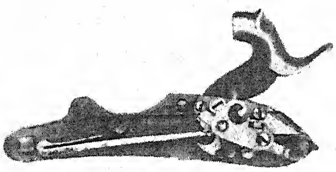
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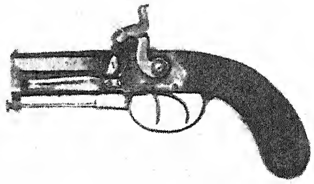
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so confused and the difference between true snaphaunce and proper flint lock is so little marked that it is quite possible that these screw barrel flint locks were the "horseman's pistols with snaphaunce," alluded to in the rates fixed by the Commission of Charles I. With the exception of the Scotch pieces of James I[1] and other Scotch pieces, I do not know of any British made snaphaunce in existence and am conscious of a growing disbelief that any were made. It is far more likely that what we call snaphaunces were early flint locks. Snaphaunces continued to be made on the Continent till about 1700, and many fine Italian pieces date from the end of the 17th century, when apparently England was turning out a relatively large quantity of fine flint lock weapons, none of them snaphaunces.

The screw breech cannon barrel type of arm was applied in 1680 on the Continent to carbines known as *à canon brisée*, which were carried in two pieces in holsters.[2] In these a swivel ring round the barrel secured the barrel to the butt, so that it could be folded when out of use. English pistols with the same kind of folding swivel are also known, but were possibly imported. The Restoration period's most interesting variations are perhaps those of early breech loading and repeating mechanisms applied both to guns, rifled arms and pistols.

There occurred with the Restoration a very remarkable revival of the luxury trade, and we find a very puzzling period where arms in a foreign style are marked as of London and with both English and foreign names. The occurrence of these rather fantastically ornamented repeating arms is not paralleled by similar decorative work on the very fine arms of contemporary English gunsmiths, and there is more than reasonable ground for looking on these complicated pieces as foreign in every way and simply

[1] In *Tower Armouries*.

[2] "About a league from Munster the Bishop (Christopher Bernard von Ghalen) met me at the head of 4000 horse and in appearance brave troops. Before his coach, that drove very fast, came a guard of one hundred Hey Dukes that he had brought from the last Campaign in Hungary; they were in short coats and caps all of a brown colour, every man carrying a sabre by his side, a short pole axe before him, and a skrewed gun hanging at his back by a leather belt that went across his shoulder. In this posture they run almost at full speed, and in excellent order, and were said to shoot at 200 yards with their skrewed guns, and a bullet of the bigness of a large pea, into the breadth of a dollar or a crown piece." Letter of Sir W. Temple to Sir J. Temple, dated Brussels, 10th May (N.S.), 1666. *Mem.*, ed. T. P. Courtney, London, 1836. Vol. I, p. 57–58.

imported here to be finished and proved. The Charter of the Gunmakers' Company in 1672 was very largely due to complaints of the trade against the importation of foreign unproved, but superior, arms, and gave them full powers of seizure.

It is probable that the charter was soon evaded by submitting foreign-made arms *de luxe* as the work of a London maker for formal proof according to the requirements of the Company.

As early as November 18th, 1663, we find that "Mr. Palmer presented the Society with a very artificial gun of Caspar Calthorp's contrivance, lodging at the same time seven bullets and powder in proportion and discharging them seven several times. Sir Robert Moray mentioned that Prince Rupert had contrived a gun exceeding all that had hitherto been invented of that kind, discharging several bullets with ease and without danger." [1]

Further research into the history of this gun only discloses that it was lent to Mr. Charlton for a month in 1664, and I can find no record of its return to the Royal Society. I found, however, something of astonishing interest, nothing less than the first known trace of the *automatic* principle.

"*March 2nd*, 1663–4.

"Sir Robert Moray mentioned that there was come to Prince Rupert a rare mechanician who pretended . . . : to make a pistol shooting as fast as it could be presented and yet to be stopped at pleasure ; and wherein the motion of the fire and bullet within was made to charge the piece with powder and bullet, to prime it, and to bend the cock." [2]

This antedates the accepted discovery of the automatic principle by just over the two hundred years. I have not to date been able to follow up any further details.

The idea of the repeating, as distinct from the automatic, gun was not a new one, for snaphaunce revolvers had been made [3] ; in fact, the early breech loading harquebuses with separate chambers to drop in, represent an early idea of getting quick repeating fire.

These late 17th century arms were, however, true repeaters, and we can fix their date very precisely, not only from the *Proceedings* of the

[1] Birch, *History of Royal Society*, Vol. I. [2] Birch, op. cit., 376.
[3] See specimens in Tower and Royal United Service Museum, Wallace Collection, etc.

before the priming reservoir, in others it is connected to the hammer or pan cover and operated by a sliding steel plate.

A rarer and somewhat later type has the powder and ball reservoirs in tubes beneath the barrel, as in modern American repeating rifles, and employed either a similar form of large wheel or a vertical roller breech block fed laterally. The sliding cross bolt or what we now call the Krupp principle, fed by two lateral magazines parallel with and on each side of the barrel is an invention of the early 18th century, so far as is known. On the other hand it seems unlikely that such a simple device had not been at least experimentally exploited at this time, when invention as applied to firearms reached to such extraordinary heights.

While repeating or self-loading principles were employed in this peculiar type of arm, we also find the revolving as distinct from the self-loading type of weapon in favour. Shot guns were made on the under and over principle, with the two barrels with their own separate steels and pans revolving round a central pivot to meet a single lock. These are said to have been made first by Giulino Bossi of Rome, who wrote on double barrelled arms in 1625.[1]

Early double pistols of this type are fairly common, and cannon barrel three chambered revolver pieces with a hand rotated breech block and a self-priming attachment were made by Gorgo, an Italian, who probably did not work, but certainly sold, pieces in London, *circa* 1670.

The repeaters and revolvers were always *armes de luxe* and have survived as curiosities. The early breech loaders on the other hand are rather rarer, probably because the breech loading mechanism could be done away with and the arm turned into an ordinary sensible straightforward weapon. I have seen much " converted " pieces and must confess that from a practical point of view such conversions were probably a wise precaution.

One of the first patents is that of Abraham Hill, 1664,[2] who obtained Letters Patent for " a new way of making of a gun or pistoll, the breech whereof rises upon a hinge by a contrivance of a motion from under it, by which it is alsoe let down againe and bolted fastly by one and the same

[1] *Breve tratato d' alcune inventioni che sono state fatte per rinforzare e raddoppiare el tiri degli arcivbugi a ruota* Paris, 1679.

[2] May 3, Pat. No. 143.

motion; and also of another gun or pistol, which hath a hole at the upper end of the breech to receive the charge, which hole is opened or stopped by a piece of iron or steel that lies along the side of the piece, and movable by a ready or easy motion; and also of another gun or pistoll which is charged and primed at a hole under the sight or vision, at the upper end of the breech, and shuts within a cartridge or roundish plate of iron and without the sight or vision, and also of another gun or pistoll which is charged and primed in like manner at a hole below the sight or vision, which is shot by a screw smaller below than above; and also of another gun or pistoll for small shot carrying seven or eight charges of the same in the stocke of the gun, which is let into the gun by the thrusting forward the sight, and with a square cartridge with a peece near the breech, so that the powder being put in by a hole under the sight, both for charging and priming the same, together with a touch hole, being shutt both within and without by thrusting back the sight to his place, and also of a powder home or box, which opens by pressing with the finger the end of the charge, or allowance, and shuts by a spring within it."

This farrago takes a deal of unravelling and covers a variety of systems. First we have the idea of a hinged hollow breech, or possibly a hinged drop bolt like the latter Warnant and Braendlin systems. Next follows a slide or type of breech of an obscure nature. We are not told how the slide worked. This in turn leads to a distinct chamber loader, probably a drop down action breech loader in which the sight was used as a locking bolt or top grip. Such pieces, or a close variation of them, were made by the French or Flemish gun merchant firm of Segallas, who sold their wares marked "London." A simpler form of the same gun is indicated in the next phrase of the specification. In these arms the backsight or "vision" is bedded on a large round screwed disc, which in turn screws into a reinforced bulge on the barrel A wheel lock gun of this type is in the Victoria and Albert Museum,[1] and some years ago I pointed out that it was an early breech loader, loaded by unscrewing the backsight. I have also seen other flint locks in private collections where this important feature had also been overlooked.

The last confused description appears to relate to a shot gun with

[1] Exhibit No. 124, 1897, *circa* 1600.

was the screw plug breech loader sometimes known as the Amusette de Maréchal Saxe. In this type of breech loader weapon the trigger guard was extended forward and connected with a large diameter screwed plug inserted in the lower surface of the chamber. The charge was dropped in loose and the breech plug screwed home again. The Amusettes date from the middle of the 17th century and were usually wall pieces, although a few carbines were made. These, so far as is known, were all smooth bores.

The earliest known English specimen is an unique arm in that it is the earliest known rifle of undoubted English manufacture and the earliest known English breech loading rifle. It was made by Willmore, who was apprenticed to Foad in 1689.[1] The piece is stocked with dark mottled walnut and has a solid silver heel plate, while the escutcheon, sideplate, and fore-end are in the ornate boldly chased silver of the period. The rifling consists of eight segmental grooves about ·030 in. deep and ·150 in. wide, the twist is one turn in 6 ft. and the bore ·660 in.; a true 16 bore. The weight of the arm is 6¾ lbs., the length 51¾ ins. over all with a barrel length (internal 35½ ins.). The lock is a simple but beautifully made flint lock of graceful design. The peep rearsight is a hinged flap pierced with three small holes, one above the other. In fact, it is a true orthoptic or "peep" sight, such as is now being adopted for the latest models of military rifles.

A companion piece, a pistol of cannon barrel type by Willmore is identically decorated with the same style of silver mounts, and in addition bears the armourer's mark F under a crown on the barrel. This is the mark of Foad, the master smith, to whom Willmore was apprenticed.

From the practical point of view the Willmore rifle handles perfectly, has a delightful balance and is a really beautiful arm. It is designed entirely as a breech loader and has no ramrod or ramrod pipes or fittings. The barrel is delicately swamped or "belled" externally toward the muzzle, but it is not belled internally; in fact, the internal diameter of the bore diminishes to ·002 of an inch less than the average diameter as the muzzle is approached. It represents a fine example of the very close and accurate work which could be done by the skilled craftsman in the days over a century ago, before machine tools and power were available.

[1] Records of Worshipful Company of Gunmakers.

The increasing perfection of firearms during the progress of the century brought about profound modifications in the technique of war-like operations. Before 1640 the musqueteer, who had to protect the squares or ranks of pikemen from the galling fire of the pistol armed cavalry, were defenceless once their pieces were discharged. Many attempts had been made to convert the musket rest into some kind of a pike, but these devices were fairly useless, as most double purpose weapons are. The pike was a long powerful spear-headed pole, long enough to keep any horseman at two full horse lengths interval from the point of the pike to the pikeman. The musqueteer was thus out of sword reach. There was at one time a fashion for arming the musqueteer with the half pike with a short bracket to serve as a rest for his piece attached to the shaft. This was unsatisfactory, for the weight of the half pike was considerable and it made a poor rest. In all probability it was further disliked by the musketeer, as it impeded his chances of jumping out of the way and dragging his rest after him by a thong attached to his wrist.

The obvious solution was to convert the musket into a defensive arm. This resulted in the bayonet, introduced in 1640 by the French. In its earliest form it was a long narrow blade with a wooden plug handle and was simply dropped into the muzzle of the musket. It had manifest disadvantages. The arm could not be refired or reloaded, and the blade, if plunged into a horse or man, would probably remain in the enemy instead of in the barrel of the musket. Later, about 1680, a ring attachment was added, so that the bayonet no longer served as a muzzle plug, and charging troops could fire, and by 1690 the socket bayonet had appeared and was adopted in the British service about 1710.

The bayonet is attributed by Continental authors to the genius of Marshal Vauban, but this is open to doubt. Its name is thought to be taken from the town of Bayonne, where they were said to have been first made in 1641. The exact date of the invention is not material, but the effect of its introduction was prodigious. The pikemen became obsolete and armour, still lingering as casques, cuirass and jack, gauntlets and pauldrons, received its final blow. All soldiers became firearm users, and the reign of armour which only protected against steel and was pierced by bullets was at last over.

The flint lock musket without a rest and the bayonet became the regulation equipment of the Austrian Army in 1684, of Sweden in 1690, and has been slowly adopted in the British service to replace matchlocks ever since the Restoration in 1660.

On the Continent the wheel lock still fought hard, and Italian and Austrian wheel locks as late as 1760 are not uncommon. It was, however, obsolete as a military arm, and its continuance was mainly as a sporting weapon *de luxe* and as a target arm for use in butt shooting by guilds and confraternities.

In Brescia "old Lazarino Comminazzo"[1] continued to make snaphaunce, flint lock and wheel lock arms of great delicacy and beauty, but these usually had locks made by a specialist of another name. The Comminazzo family were barrel smiths, and mounting and lock making were done by other craftsmen, though the arms were, I think, stocked by the Comminazzos.

The close of the century in England shows us a condition where private folk had excellent flint lock arms of reliable workmanship and good lines. These were usually stocked with walnut wood and mounted in silver; in the case of pistols the butts were capped with silver lion masks. Shot guns and rifles had also silver shod heel plates and often the chasing was of great beauty.

Repeaters and revolvers of intricate design were sold in London, but were probably of alien origin, and the vogue must have been a relatively short one, probably owing to the dangerous nature of the arms.

The period 1660–1680 was essentially one of experiment in breech loading arms and the ramrod was not a customary article of equipment on screw breeched weapons, and is only found on the very long horseman's holster pistols meant for military use and on muskets and fowling pieces of the conventional type without the screw breech.

The Regular Army was equipped with strong flint lock muskets and socket bayonets. The Cavalry were issued with flint lock pistols with 14 in. barrels and a bore of ·60 in. (twenty bullets to the lb.) as early as the period of James II (1685–1689), and the pattern alters very little for the next half century.

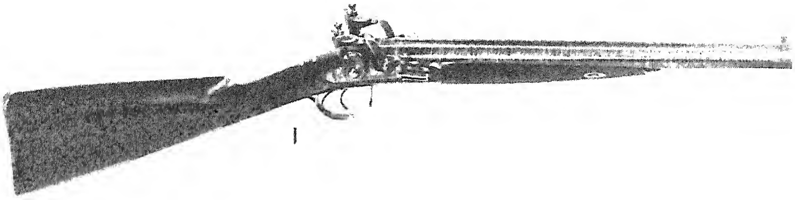
The bandolier of Parliamentary days gave place to the simpler powder

[1] See *Evelyn's Diary*.

GUNS AND PISTOLS

1. Double barrelled flint lock by Durs Egg, made for the Prince Regent, later George IV. (Mr. Max Baker's Collection.)
2. Hammerless flint lock by Paczelt of Prague, 1738. The fore trigger cocks the plunger, and the V section piece which can be seen hinged into the barrel acts as a steel.
3. Needham's Bolt action double barrelled shotgun. A modified needle gun cartridge is employed. (Mr. E. J. Churchill's Collection.)
4. Silver-mounted Spanish fowling piece with typical Southern Spanish stock. The barrel is English by Tover, *c.* 1760. (Mr. E. J. Churchill's Collection.)

5 and 6. Collier flint lock revolver with self-priming flash pan. The cylinder has to be rotated by hand and is pressed by a spring against a sleeve on the barrel end which forms a gas-tight joint with the cylinder. A later percussion pull lock model was made. (Mr. Harrod's Collection.)



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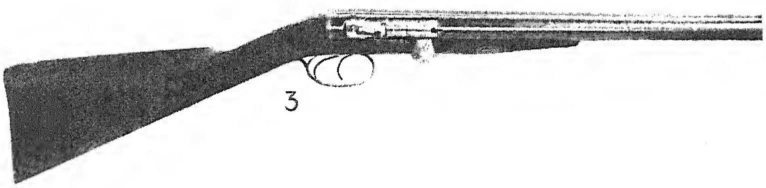

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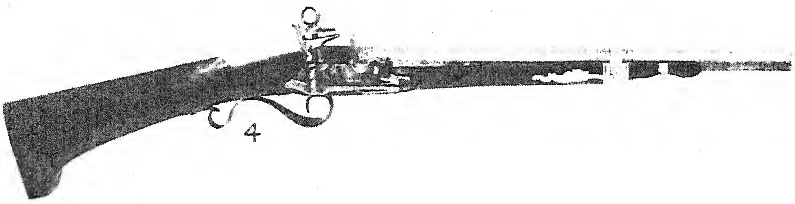

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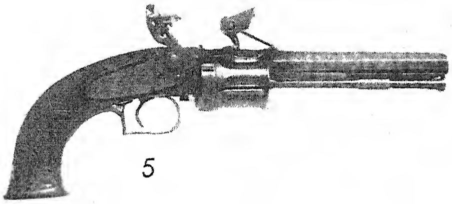

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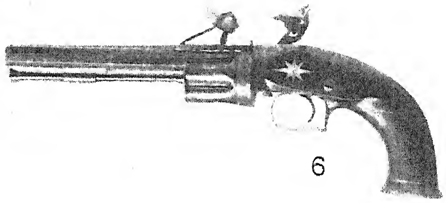

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flasks and bullet pouch, and only the train-bands retained the old match lock calivers and match. The first half of the next century shows practically no serious advance in design, but rather a condition of stabilisation and minor modification of the settled designs evolved during the second triad of the 17th century.

CHAPTER IV

THE 18TH CENTURY

THE change from the 17th to the 18th century was not a very abrupt one, but by 1725 the early large type of chambered screw barrel pistol had almost disappeared as a first quality weapon and had been displaced by a shorter version of the thin barrelled full stocked military pistol, with wood reaching all the way to the muzzle, ramrod and no chambered breech. The screwed cannon barrel type, however, continued for pocket pistols of best quality, for cheap box lock pistols and for double and multiple barrel arms, for which it was singularly well adapted.

The general tendency in regard to sporting arms and pistols is a very marked reduction in the weight both of the metal of the barrels and also the mountings and wood of the stock. The metal of barrels becomes lighter and thinner, approximating rather to shotgun than rifle proportions. Stocks become slenderer and the pommels return to the flattened oval section popular about a century earlier. The singularly club-like silver mask mounted pear-shaped butt of the typical James II cannon barrel pistol is modified even in the pistols where this particular style of butt mounting is still preserved, and the wooden grip possesses a rather sharper downward curve and is much more reduced in its section as it approaches the pommel or butt.

The finial of the trigger guard, which in early cannon barrels often overlays the proof and maker's marks, disappears, and in this type of "Queen Anne" cannon barrels of the last two decades of the 17th and first decade of the 18th century it gives place to a simple trigger guard with no forward extension or finial. This is often movable on the base plate of the lock and serves as a safety lock, an intercepting projection inside preventing movement of the tumblers.

The whole system of a chamber breech with only one side plate integral with the breech and carrying all the lock work now gives way to a new type of lock, the box lock.

In the box lock the old extension of barrel breech and lock plate is preserved, but a metal top cover and a left hand plate are added, so that in the box lock the whole lock mechanism is now enclosed in a five-sided metal box instead of having three sides in metal and two in wood as previously.

This system of construction enabled the hammer or cock to be placed centrally and vertically behind the axis of the barrel and the flash pan and steel sited on top.

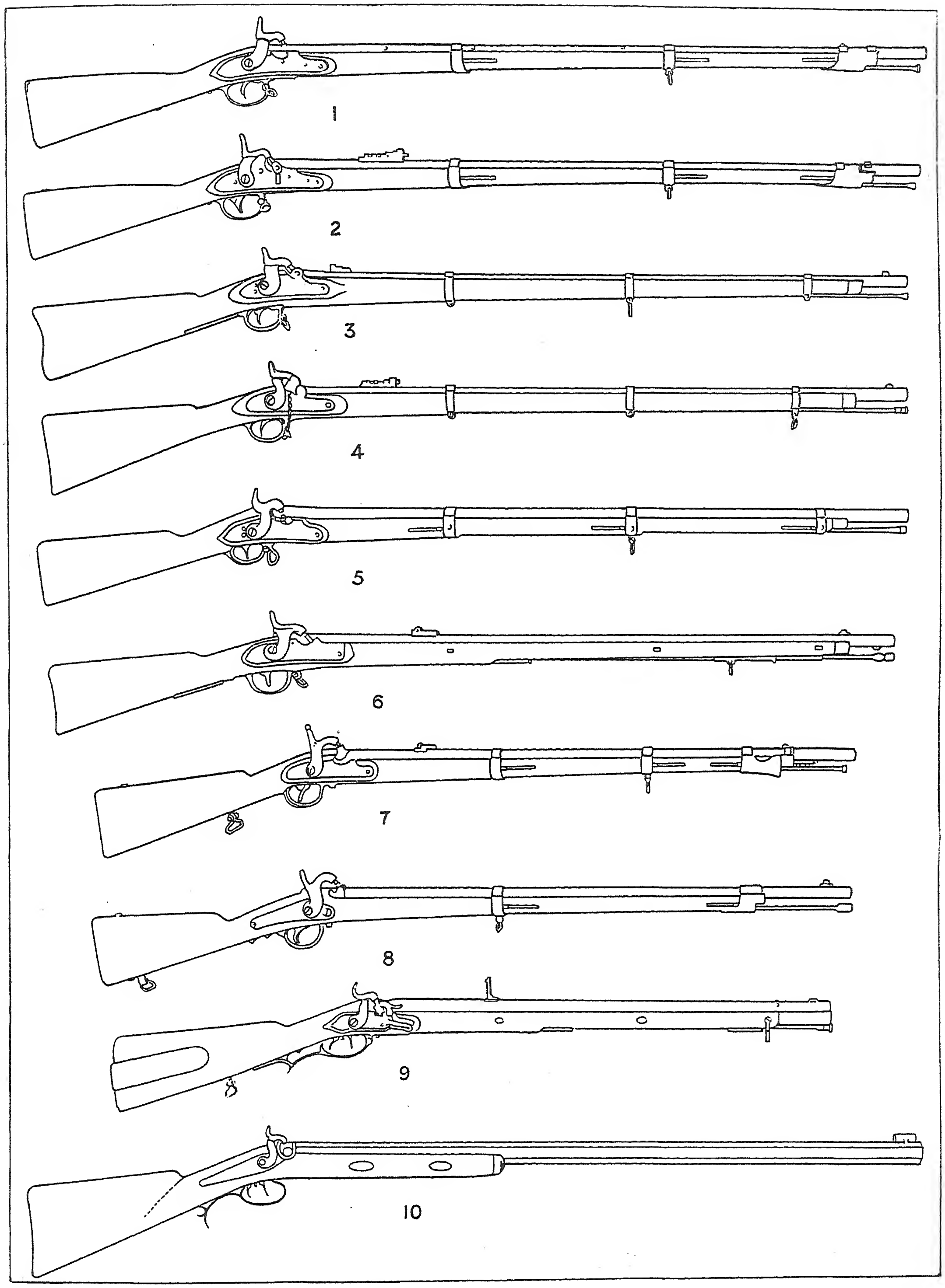
With pistols of this nature no precise line of aim can be taken, and there is little doubt that it was first introduced simply for pocket pistols for use at close range. The simplicity of the system and its relative ease of manufacture made it popular, and from 1730 onward far larger pistols of this box lock type made their appearance. Costume may have affected this, as the longer frock coat and larger pockets afforded greater facility for carrying a more substantial weapon. The box lock type was not however a military arm, and was not used either by officers or the rank and file, neither was it a horseman's arm or commonly mounted with belt or sash hooks. They appear to have been made for the Indian market after 1750, and to have been in fairly general use as carriage pistols and weapons for house and road defence.

The general arm of the period was the ordinary side flint lock which was applied to muskets, fowling pieces, horse pistols, military arms and gentlemen's arms in all varieties. It is essentially a standard article which alters very little even in detail until superseded by the percussion system. The changes which do occur are mostly associated with the dominant feature of the latter half of the century, the development of the duelling pistol.

The duelling pistol is entirely unknown until about 1760. By this I do not mean that duels were not fought with pistols before this date—for they were, and one can go back to the celebrated duel of King Charles I's dwarf, Jeffery Hudson, with Mr. Crofts, a courtier. Hudson, though a dwarf, was a man of courage and was appointed to command a Troop of Horse during the Civil War, during which he did good service. He later

PERCUSSION RIFLES

1. French musket converted to percussion from flint lock. A new hammer is fitted to the original lock and a nipple screwed into the top surface of the barrel. This was the simplest method of converting flint locks and was widely practised.
2. The U.S. Springfield model musket converted from flint lock to percussion, *c.* 1850. In this type the Maynard primer lock was used, but this was later abandoned and during the Civil War the ordinary percussion cap was used.
3. U.S. Civil War rifled musket, 1863. This arm no longer resembles the 1777 Charleville model, but follows contemporary European practice.
4. British Service Enfield rifle, calibre ·577, with nipple protector on chain. Date 1857. In later models the nipple protector is no longer used although retained on carbines. Variations occur in the detail and the last models are rather lighter and more refined than the first issues. The bulk of these latter Enfields were later converted into Snider breech loaders.
5. German rifled musket of 1840, calibre ·75.
6. Austrian rifled musket of 1840, calibre ·70. These were the weapons later so disastrously defeated by the needle gun, but they were not inferior to the average European muzzle loading rifle of their time.
7. Austrian carbine, 1857. A typical converted and cut down flint lock musket adapted for the use of artillery and army troops.
8. French carbine model of 1840. This arm introduced the back action lock. This was adopted for all arms in the French Service, and is found on the double barrel rifles of sporting type made for the French marines, and on pistols.
9. German Jaeger rifle, calibre ·60. These arms were a Service issue, but show the traditional German hunting rifle influence. They retain the patch box in the butt and the set trigger.
10. Percussion match or target rifle of 1855. These extremely long barrelled and heavy pieces had complex orthoptic rear sights and hair triggers. They were a very different weapon to the military rifled musket of their time.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accompanied Queen Henrietta Maria when she took refuge in France. There he was jestingly accused by a Mr. Crofts of the Queen's Household of having been worsted in a fight with a turkey cock. Hudson was furious and challenged Crofts to a duel. On reaching the ground Crofts was found to have brought a squirt as a weapon. This was the ultimate insult, and the dwarf insisted on fighting Crofts a duel on horseback, both parties being armed with pistols. He killed Crofts at the first fire, the bullet passing through his heart.

The pistol was not the usual weapon at this period or subsequently, and affairs were customarily decided with the rapier or small sword. We find though that at some of the French duels, where seconds as well took part, pistols were used as a secondary or even primary arm. The duel between the Duc de Beaufort and the Duc de Nemours in 1700 was begun by de Nemours firing a pistol at de Beaufort but missing, whereupon de Beaufort fired and shot de Nemours through the stomach. Four seconds were engaged on either side and two were killed in the ensuing sword play. The mounted pistol duel was a survival from the practice of the early 17th century and probably a direct descendant of the mounted sword combat of the knights. It endured till 1759 in savage and backward countries like Ireland. In that year Colonel Jonah Barrington and Mr. Gilbert[1] fought. The combat took place on horseback, the weapons being two horse pistols "loaded to the muzzle with ball and 'swandrops,'" swords of the contemporary cutting type and "Skeenes," the long broad bladed dagger of the Celts. Colonel Barrington was shot in the face at the first encounter, but the large ball missed him and the "swandrops"—that is, large pellets, merely broke the skin. He was ultimately victorious.

The use of pistols for duelling became general as the practice of carrying the small sword died out between 1750 and 1765. In the early days no special duelling pistols existed and meetings were fought with horse pistols. The duel of Mr. John Wilkes and Lord Talbot in a formal affair at the Red Lion, Bagshot, in 1762, was fought with horse pistols.

"When I had sealed the letter I told his Lordship I was entirely at his service, and I again desired we might decide the affair in the room because there could not be a possibility of an interruption, but he was quite inexorable. He then asked me how many times we should fire: I

[1] *Memoirs of Sir Jonah Barrington.*

said I left it to his choice. I had bought a flask of powder and a bag of bullets. Our seconds then charged the pistols which my adjutant had bought. They were large horse pistols. It was agreed that we should fire at the word of command to be given by one of our seconds. They tossed up and it fell to my adjutant to give the word.

"We then left the room and walked to a garden at some distance from the house. It was near seven, and the moon shone brightly. We stood about eight yards distant and agreed not to turn round before we fired, but to continue facing each other. Harris gave the word. Both our fires were in exact time, but neither took effect.

"I walked up to his Lordship and told him that I now avowed the paper. (A paragraph in the *North Briton*, 21 August, 1762.) His Lordship paid me the highest encomiums upon my courage, and said that he would declare everywhere that I was the noblest fellow God ever made. He then desired that we might now be good friends, and retire to the inn to drink a bottle of Claret together, which we did with great good humour and much laughter." [1]

The period from 1760 to 1775 shows a marked development of the horse pistol into the true duelling pistol, and the latter becomes an officially standardised weapon in 1777. In the "Code Duello" drawn up as a general guide to the correct practice of duelling at the Clonmel Assizes, 1777, it was laid down that the pistols should be 9 or 10 in. barrelled smooth bore flint locks of ½ in. bore, carrying a ball of forty-eight to the pound.

The requirements of duelling called for a pistol of exceptional reliability, unusual accuracy and a particularly carefully thought out balance and design of grip. The military pistols of the period were customarily unprovided with sights or even a groove over the breech which would guide the eye, although the sights and groove occur on the best Continental made arms of the age.

The first sign we find of this desire to make the pistol more of a weapon of precision is the "swamping" or raising of the muzzle, so that it appears slightly larger in diameter at the mouth. The design is to raise the muzzle to something of the same level as the breech. No foresight is fitted, but the breech end of the early duelling pistol is usually forged octagonal, and the standing breech on the butt is grooved so that a guiding line of sight

[1] Letter from John Wilkes to Lord Temple.

arms, Customs officers' weapons and rough semi-service type pieces which are very difficult to place in definite categories, except by actual examination of the piece.

There are, however, certain very definite types of arm which form types apart. The first of these is the old coach pistol supplied to the guard of the public stage coaches. He was armed as a rule with a short blunderbluss with a brass barrel and a pair of pistols with brass barrels and brass lock plates. The barrels are usually numbered, for the coach house or company would have many pairs in service and they bear engraved on their butts the crest or coat-of-arms of the particular coaching line they were supplied to. Coach pistols are extremely rare, but were made with flint locks and brass lock plates until 1835.

Other pistols of military type with brass barrels were supplied to officers for sea service, for the brass or gun metal was held to be less prone to rust than steel. These pistols have, however, steel locks and are not numbered and crested as the distinctive coach pistols.

Another peculiar and extremely valuable type is the Scotch pistol with all-steel or gun-metal butt. These represent a special type of arm which was primarily of Spanish origin, but which was developed in Scotland by local craftsmen. In 1609 James I was sending gift weapons of Scotch make to the Infanta of Spain. By 1646 a minor Scottish industry of firearm makers had been established at Doune in Stirlingshire by Thomas Caddell and other gunsmiths. A long line of pistol makers followed, and at the beginning of the 18th century the all-metal flint pistol, with either a bulbed or a clawed or rams'-horn butt was part of the ordinary Highland full dress. The troubles of the Stuarts and the Jacobite risings spread many Scots officers about Europe, and the type of all-metal pistol became known on the Continent as an *Écossaise*, a word which soon applied to many small pistols, but in particular to the little all-steel Continental cannon barrels often marked Segallas, and box lock pistols with folding-bayonets.

The disarmament of the Scots and the disaster of Culloden, 1745, did much to eliminate the trade, but it continued down to 1825, although subsequent to about 1730 many of the pistols were made at Perth, Stirling, Edinburgh and other towns. A fuller note is given on the whole subject of Highland pistols in Appendix III, but it is worthy of note that a

substantial military version of these arms was introduced into the British army for the use of the Royal Highland Regiment. These pistols were an all-steel rams'-horn type with sash or belt hook, pricker and steel ramrod, and the barrels were made by Bissel, a Birmingham trade gunmaker, certainly before Culloden, 1745, and probably when the regiment was raised. Similar but rarer pieces have gun-metal kidney-shaped butts and bear the barrel maker's or armourer's mark of John Waters of London, 1720–1770. They were made for Highland use at Stirling.

The condition of Scotland subsequent to the rising of 1715 has been described as a disarmed Highlands and an unarmed Lowlands. That this was the case is all too apparent from the situation which confronted both the loyalist, General Cope, and the Young Pretender in 1745. An immediate reduction of the rebellion by loyalists was impossible for want of arms, and on the other side the Prince was unable to equip the men who came to his standard. The wisdom of this policy of disarmament was proved by the issue of events.

So far as can be gathered, the Highlanders, although short of muskets and lacking all artillery, were well equipped with broadswords and pistols. At Prestonpans they obtained the arms and equipment of Cope's defeated dragoons. When they reached Derby the force amounted to about four thousand men, "the guards and officers are all in Highland dress, a long sword, and stuck with pistols; their horses all sizes and colours" (Lord Mahon, *Extracts from State Papers*). At Falkirk Muir the Highlanders, advancing on foot to meet Ligonier's cavalry, completely routed the dragoons with successive volleys of pistol fire supplementing their rather scanty musketry. After Culloden a number of these Highland pistols by Bissel and Waters were deposited in the Tower Armouries, with the other captured arms.

It seems probable that they were weapons originally made for the Highland Regiment and the Argyllshire Regiment, which had been captured by the rebels and were won back from them.

They may also have been part of the regulation stock of arms maintained in the Scots garrison armouries for the arming of local levies. The earlier gun-metal butted ones are not marked with the name of the maker or of any regiment, and it seems probable that they were also a general service issue for the Scots troops. No private arms of this pattern

appear to have been made in England at this time in the century, and considering the great estimation in which this type of piece was held it is improbable that if the manufacture had been started in England it would have been solely confined to arms for the Governmental requirements.

The great English military weapon of this century was the flint lock musket, the "Brown Bess." This was a general name for the regulation infantry musket and was in use as a soldier's term to describe the weapon until the date of the Crimean War. The origin of the name is popularly supposed to date back to Elizabethan times, but it is more probable that "Bess" is derived from the original "Buchse" of the Germans. The adjective "Brown" applies to the familiar russeting or browning which was applied to armour and gun barrels in order to make them more rust proof.

The muskets of James II, William III, William and Mary and Queen Anne show no important differences. The locks are usually marked with the Royal Cipher of the reign of manufacture and the barrels show both makers' and viewers' official marks. The whole army was equipped with flint locks in 1690, but it is probable that some time elapsed before the rearmament was complete and all old arms either converted or sold out of service.

The Tower of London was the examination office, and arms made both in Birmingham and London were sent there to be viewed, approved and stamped. The manufacture itself was carried on by masters or contractors, who sublet contracts for parts to outside workers and only assembled the components at their own factories. The makers' name does not appear on the majority of arms, but it can be frequently determined from the armourers' mark on the barrel.[1]

During the reign of George I the letters G.R. were adopted, but successive Georges did not add any variant. A "Brown Bess" marked G.R. may therefore date anywhere between 1714 and 1830. The later models can, however, be recognised as being of rather more mechanical workmanship and having a flat double-necked hammer. The Broad Arrow, as a sign of Government property, was adopted during the reign of

[1] The crowned rose was last used as a mark during the reign of Queen Anne. See Appendix for makers' marks.

George I, and the word TOWER is marked on the lock plate of many of these arms.

The " Brown Bess " was known in Ireland as a " King's Arm " from its use by William at the Battle of the Boyne; later the words " Queen's Arm " were used to distinguish those of the reign of Queen Anne during the 18th century. All later arms of this type were known as " Tower muskets."

The praiseworthy habit of official economy led to alterations and remodelling of old and part worn weapons, and I have seen Tower muskets with very early stocks with far later locks. Some early examples are certainly converted from match lock stocks, but there is too much confusion to pick out definite date marks with any reliability.

The full size grenadier and heavy infantry musket was a heavy weapon weighing 11½ to 12½ lbs. The bore varies from ·77 to ·80 and takes a ball of twelve to the pound. The barrel is usually 45 or 46 ins. and the butt plate and mounts are invariably brass. Unlike Continental and American military muskets the barrel is not held to the stock by metal bands or rings, but is secured as pistol barrels are secured by pins passing through lugs beneath the barrel and through the wood of the stock. There are four ramrod pipes.

A lighter model weighing 11 lbs. 4 ozs. and with the barrel reduced to 42 ins. succeeded it about 1750 as a weapon for the light infantry, but previous to this a short musket or " musquetoon " of 36 in. barrel was in use, as well as carbines of 31 ins. These latter were the arms of the dragoons and cavalry, and it is noticeable that the carbine of 31 or 32 in. barrel used at the beginning of the century was superseded about 1750 by the 36 in. barrelled arm and that this was in turn cut down again to 26 in. about 1770. At this time, too, the steel ramrod was substituted for the common wooden one.

Arms were made for the Government for sea service, for the East India Company, for the militia and coastguards, and even for privateers. These weapons are usually modelled on a regulation style, but deviate from the official sealed pattern in many minor respects, such as steel in place of brass fittings, barrels of shorter length, smaller locks, etc., but the standard official calibre is always maintained.

It is noteworthy that there never was an official State-maintained arm

factory.[1] Arms were made in London and Birmingham, but the arms made at the latter city were always mediocre plain regulation arms or export merchandise. Very few quality arms were made there and the fine work and gentlemen's arms all came from London. The tradition endures to-day, and London arms still maintain their superiority over the wares of Birmingham.

The French, on the other hand, established their "Manufactures Royales" at Charleville, St. Etienne and Maubeuge in 1718, and to all intents and purposes standardised their regulation musket.

Prior to this no uniformity had been insisted on except that of calibre. Every regiment had its own weapons, which varied in dimension and quality. The 1717 French musket[2] was very like the English musket, except that the bore was much smaller, eighteen balls to the pound, and the pan had a squared or half hexagon section. The barrel of 44 ins. was pinned to the stock except for one external band coupling barrel and stock.

The model of 1728 is closely similar, but the pins are replaced by bands.

In 1746 the French introduced the double-necked hammer and the steel ramrod, improvements upon which were rapidly adopted by the British. The weakness of the old swan-necked hammer or cock was a tendency to break at the narrowest part between the disc or breast and the flint holding jaws. The double-necked cock eliminated the weakness, but was not adopted on arms of the first quality until late in the nineteenth century. This was probably because it looked ungraceful, and a well-forged single hammer would not break. It was not a new invention, for it is often found on dog locks of 1670 and other early arms.

The French models of 1745 differ slightly in details of mounting and is in turn superseded by that of 1763, which introduces the muzzle band with a funnel or guide for the ramrod and a corn sight integral with the band.

This model is important, for it was the type copied by the American

[1] Until the Birmingham gunmakers struck for higher wages in the middle of the Crimean War and the Government established Enfield as a Government factory. The financial loss to Birmingham working gunmakers from almost a century of Government competition is of some interest as an instance of the economic penalty.

[2] Botet, *l'Arme a feu Portatif.*

gunmakers when making arms for the War of Independence. The total length is 4 ft. 11 ins. to 5 ft., barrel 45 ins., calibre 70 (eighteen or nineteen balls to the pound), weight 10½ lbs. The muzzle band is of brass, secured by a flat press spring of steel set in the wood, and carries a foresight on its rear band. A stud on the barrel served as a bayonet retaining device. The hammer was double-necked and stamped from flat iron, not rounded in section and forged as in the earlier swan-necked type.

The squared pan is still retained and the arm was serviceable, robust, and deemed at that time to be the best regulation weapon in Europe. A 29 in. barrel musquetoon with brass mounts was also made in the same style. The models of 1766, 1768, 1771, 1773 and 1774 vary in detail of mounting.[1]

The model 1777 is easily recognised as having a rounded brass pan and many minor refinements. It is lighter, 9½ lbs., and the lock is of more efficient design. All screw heads are flat. Mounts are normally brass; occasionally iron bands occur. Weapons of this type are not uncommon among military trophies. The variants are: the dragoon musket or light infantry weapon of the fantassins with 42 in. barrel, iron barrel bands; the artillery musket 36 in. barrel, brass barrel bands; sea service musket as above, but all the bands brass; cavalry musquetoon 33½ in. barrel with sling loop and ring on left-hand side. In 1786 another lighter cavalry arm with a short 28 in. barrel was issued. It is otherwise similar to the preceding model.

In 1792 the outbreak of the wars of the Revolution led to the cessation of standardised arms, and weapons of inferior workmanship and reduced calibre were issued to the Republican troops until the stabilisation of the situation in 1801.

The French issued no official pistol prior to 1763, and in general a long 12 or even 14 in. barrelled holster pistol with a heavy brass pommel and squared brass pan with a high flash fence was in use.

These were of the same bore as the muskets (eighteen balls to the pound) and consequently rather larger than the conventional English 20 bore. In 1763 they first issued a pistol which has the peculiar front muzzle and stock band we find in the French musket. It was short barrelled, 8½ ins., for its length of 15½, very straight and long in the stock and provided with

[1] For details see *Des aides Memoirs General Gassendi*, 1809.

a steel ramrod. The wooden fore-end extended into the muzzle band about an inch behind the muzzle. A reduced version of this with a 5 in. barrel was issued to the gendarmerie. These pistols are unmistakable and have the place and date of manufacture on the breech and the model engraved in shallow script on the tang which runs down the butt. The factory name is usually coarsely cut in script on the lock plate. The mounts are both iron and brass, and as the model was made during the Revolutionary period they are often of poor manufacture. The model 1763–1773 was succeeded by a curious weapon, the model 1777, which is a reversion to the semi-box lock of the old James II screw barrel pistol. It is a crude piece with a plain round iron barrel with no wood fore-end, the ramrod slides through to the butt and a clumsy iron strap connects breech and butt pommel. A big brass trigger guard screwed to the base plate of the lock completes the assembly. The barrel is usually 7½ ins., but shorter pieces were made or perhaps cut down for different service at a later date. It is now becoming rare.

It is curious to note that a special 1763 officer's model pistol consisting of a reduction of the service model fitted with a set trigger and a neatly curved or "bird-head" type of butt was also made. It appears to be the first time that "Officers' model" pistols were issued to a regular army.

The German and Austrian regulation muskets and pistols follow rather more closely on English than French lines. They were crude weapons, but usually marked with the makers' name or official stamps on lock and butt. They can be distinguished from English and French pieces by a brass or iron cap to the top of the fore-end below the barrel. The muskets have a typical solidity of butt and often the cheek piece favoured to this day by German riflemen.

The various small kingdoms that now compose the German Republic had arms of local manufacture. Potsdam and a Crown are found on late 18th century Prussian pieces. In general their arms were as poor as their exchequers.

Among other service arms of limited use we find a certain number of blunderbusses. These were mainly for Naval use and were issued to boarding parties. Big blunderbusses mounted on swivels were also used in the bows of small boats.

There is also a tradition that the bell-mouthed brass blunderbuss

CURIOUS AND MISCELLANEOUS PISTOLS

1. Flobert saloon pistol for rim-fire caps. This type was made from 1860 to the present century and had no breech bolt. The inertia of the heavy hammer serves to prevent the blowing back of the case.
2. Double barrelled octagon barrelled pistol by Egg. This unusual piece shows the refinements of the best late duelling pistol design. (Mr. F. Russell's Collection.)
3. Kuchenreuter duelling pistol, *c.* 1780. These arms are highly appreciated by Continental collectors but were not so good as the best British work of the period. They have very flat fishtail butts and a double leaf backsight such as is found on sporting rifles. Barrels of this length are rare in this type of arm. (Mr. F. Russell's Collection.)
4. Four barrelled tap action repeating flint lock with inlaid piqué butt and silver butt mask.
5. Four barrelled revolving flint lock with separate pan cover to each barrel. The arm is of South German origin and dates from the late 17th century. (Mr. F. Russell's Collection.)
6. Early breech loading pistol by Colombo, *c.* 1850. The rotating breech block admits a ball on one side and a heavy cap on the other. There is no provision for a powder charge.
7. Forsythe detonator. This is a vest pocket model with closed powder reservoir and folding trigger. (Mr. F. Russell's Collection.)
8. Axial type percussion revolver. Noel's patent, *c.* 1850. A lateral hammer strikes the nipples through the holes in the side plate. Ratchet movement revolves the vertical wheel which is chambered radially for ten shots. (Mr. F. Russell's Collection.)
9. Reverse of No. 7, showing the link connection between hammer and powder reservoir.
10. French éprouvette or powder tester. The discharge blows the graduated disc round against spring friction registering the force of the explosion.
11. Modern vest pocket revolver for automatic pistol cartridges and modelled on the lines of automatics.
12. High velocity modern vest pocket revolver, Velo-Dog. These weapons fire a 5 mm. high velocity cartridge with a copper coated bullet.
13. A similar arm but with a thumb operated break down action and automatic ejector.
14. Modern German pocket revolver of conventional pattern.
15. Austrian ten shot gendarmerie revolver with opening frame and hand detachable lock members.


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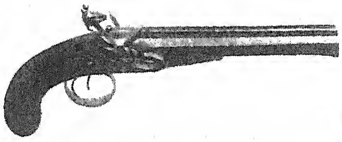
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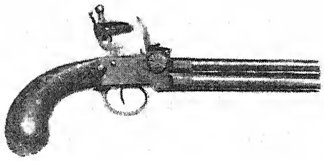
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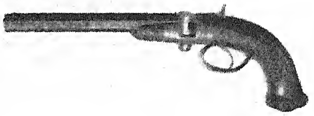
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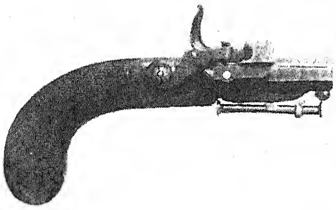
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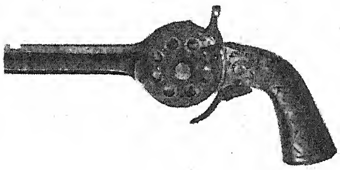
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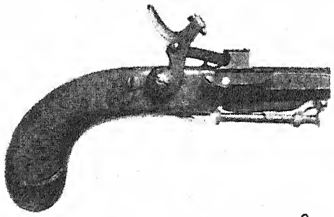
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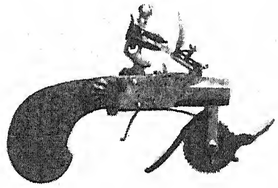
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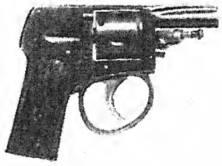
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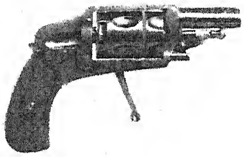
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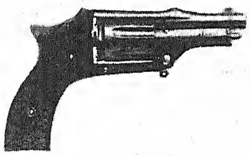
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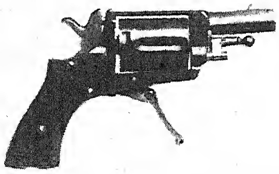
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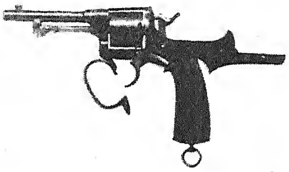
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pistols were used for boarding parties, but I can trace no authority for the statement so far as the British service is concerned. I am inclined to believe that they were made for house and carriage defence and for the Oriental market.

French pistols of this type are noted as Pistolets de Mameluks,[1] and arms of this type were still in usage by Arab warriors in Morocco and Tripoli when I was a traveller there seventeen years ago. It is possible that they were used in the Republican Navy owing to the shortage of arms.

Big wall pieces or pivot guns, which are to all intents and purposes giant muskets, firing a ball of four to the pound (·94 ins. calibre) are also relatively common. They are usually provided with a rowlock type pivot, and sometimes have folding sights and a ring trigger fired by the pull of a lanyard. The English version was a 6 ft. edition of the "Brown Bess," and was made as a stockade gun for foreign trading companies.

Muskets were sometimes fitted with Grenade Cups, and interesting specimens of these are in the Tower Armouries and the R.U.S.I. Museum.[2] Their use apparently went out early in the century to be revived again during the late war. Other peculiar rough or service type pieces, which are sometimes misleading, are early century whale guns which were used for firing harpoons and in particular rocket guns. These have light brass or copper tube barrels of large bore and often have a hinged backsight and big flash preventing shields. They are often a puzzle to collectors.

The important military development of the last decades of the 18th century was the gradual appreciation of the importance of the rifle as a military weapon. Rifled arms had been made since 1540. They had been sporadically brought forward at intervals ever since, and the 1689 English breech loading Wilmore rifle mentioned in the preceding chapter shows that English gunmakers were familiar with the advantages of the rifled weapon over the smooth bore. These advantages were largely stressed by Robins in 1740.[3] There was, however, one very strong disadvantage which made the large bore muzzle loading rifle unsuitable for military service. With the black powder arm thick fouling soon choked the rifling so that a tight fitting ball could not be easily rammed down, but actually had to be

[1] *L'Anuaire de Versailles*, 1809.
[2] Used at the siege of Oxford.
[3] Robins original MS. are in possession of the Royal Society.

hammered down. If the ball did not fit tightly it did not " take " the grooves of the rifling and the piece was no more accurate than a smooth bore.

The military mind of 1775 was not accustomed to the idea of precision. There was no finicky idea of hitting an individual aimed at if he was more than sixty yards away. Sniping or sharp-shooting was unknown, or perhaps looked on as bad form and likely to add to the horrors of war. Musketry fire was a body of fire directed at an opposing line or square before close conflict with the bayonet.

Men of science, such as Benjamin Robins, F.R.S., had worked out the principles of gunnery and spent much time and ink pointing out the superiority of the rifled weapon. It was, however, evident that so far as the rifled musket was concerned, it was no use as a service weapon because it was so difficult and slow to reload. They also probably thought they could never teach the men to use them and that precision of fire was of little tactical value. The solution seemed to lie in the breech loader, and it is evident from the curious specimens of breech loading devices which exist that breech loading was looked on by the early inventors not so much as an end in itself for speeding up the rate of fire as a means of getting round the difficulty of loading a fouling choked rifle.

The outbreak of the American War of Independence in 1775 brought us into contact with a new military phenomenon—the rifle armed sharp-shooter who took cover and shot accurately at ranges far beyond the compass of the army musket. The Americans had evolved a new type of arm suited to their environment. They needed a reliable, accurate hunting weapon, efficient for use against Indians, and of *small calibre*. They had to go into the forest on long trips, carrying with them their supply of powder and ball. Weight was vitally important and had to be reduced as far as possible. Accuracy was essential, as life might hang on a shot. To meet the needs of the colonists their own gunsmiths evolved a special weapon generically known as the Kentucky rifle. The typical weapon had a 42 in. barrel, weighed about 9 lbs. and carried a half ounce ball of thirty-two to the pound. They had long octagonal barrels and slender stocks of maple wood fitted with a curved or recessed heel plate and a patch box.

The secret of their value lay not so much in their accuracy, which was

good rather than remarkable, but in a simple trick of loading. The European rifleman used a tightly fitting lead ball which he slammed down hard with ramrod or mallet and rod until it expanded to fit the grooves of the weapon. The American simply wrapped his bullet, which was small, in *a greased leather circular patch*. Reloading a fouled rifle was no trouble to him. His loosely fitting projectile could be pushed home as swiftly as a ball could be wadded into a smooth bore. The patch lubricated the bore and took up all space which might otherwise be free to let explosion gases pass the ball.

Among our officers of the time was Major Patrick Ferguson,[1] who was a keen student of firearms. He appears to have appreciated the value of the principle of rifling and to have studied the existing breech actions. In 1776 he took out a patent[2]: "Improvements upon Fire Arms. The specifications and plans describe breech loading guns in which a screw plug is used, which, by a turn, is made to rise so as to fill up the bore and may be made to descend in a contrary direction; or the changing chamber may be closed by a slide, or by a revolving perforated plug like that of a tap. The plug may be turned by the trigger guard."

In effect, Ferguson's rifle consisted of a multiple-threaded vertical screw plug slightly larger in diameter than the bore, with a quick action thread passing from the fore part of the trigger guard through a bulb top of the barrel. A rotation of the trigger guard lever gave access to the bore. A bullet could be dropped in, a charge of powder poured behind it and the screw closed. The sighting was from 100 to 500 yds. and the weapon was simple and efficient and furnished a fair gas check.

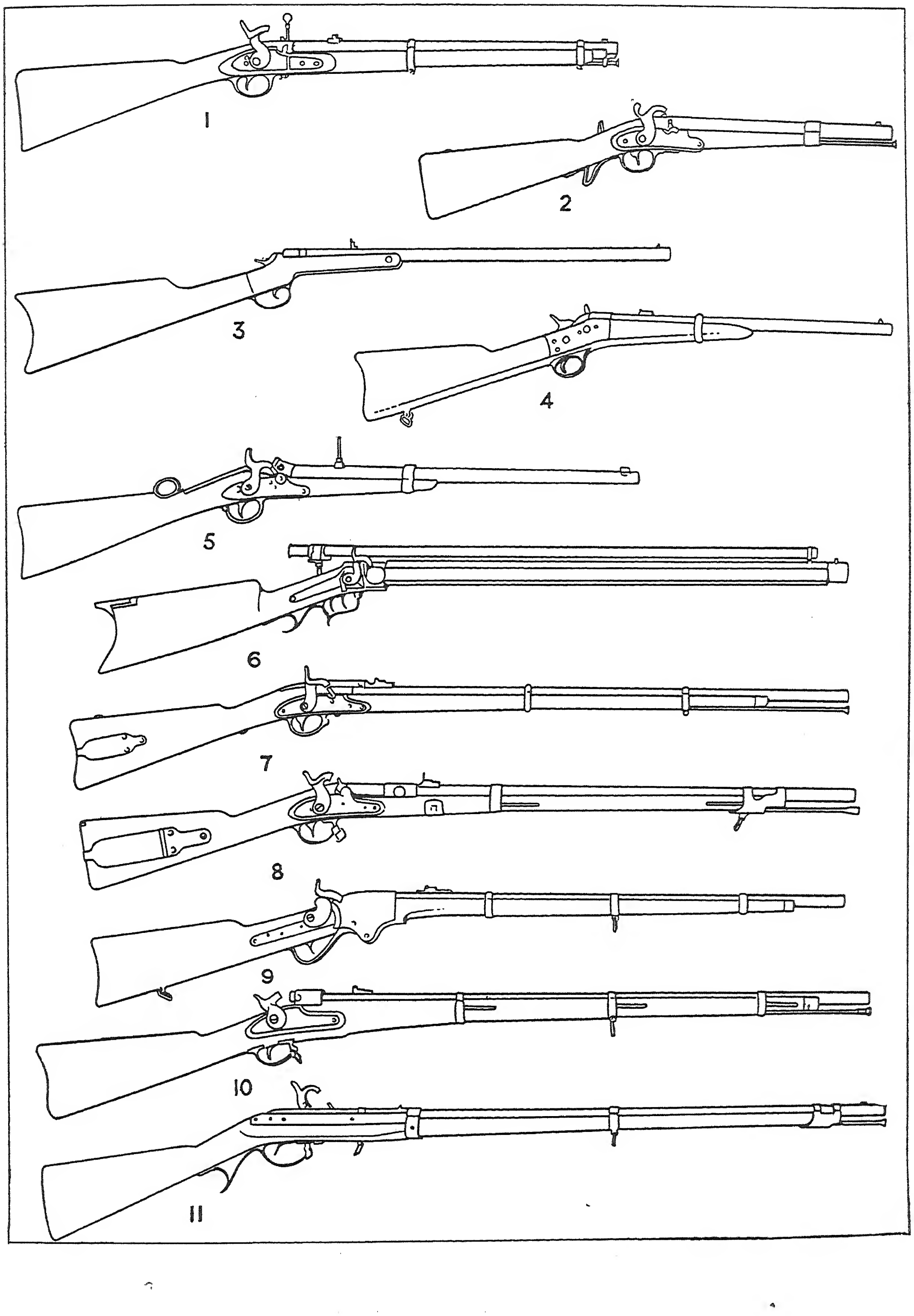
In essence, the Ferguson patent is only a slight advance on the earlier screw plug arms. Several exist on the lines of the Willmore rifle, and an early Continental example of about 1720 has the plug going through to the top of the barrel. The quick thread was apparently a novelty, but, above all, Ferguson was an enthusiast and could get authority to listen to him.

"On the 1st June, 1776, he made some experiments at Woolwich, before Lord Viscount Townsend, Lord Amhurst, General Harvey

[1] Major P. Ferguson, 71st Regiment, Highland Light Infantry.
[2] No. 1139.

NINETEENTH CENTURY WEAPONS

1. Enfield carbine, ·577, with stirrup ramrod to prevent loss of the latter.
2. Belgian carbine, ·76. These were made from converted flint locks, and were later manufactured in bulk for trade with West Africa.
3. Wesson's breech loading carbine, 1859, ·44 rim fire calibre. Forerunner of numerous small single shot weapons on this system.
4. Remington carbine, calibre ·56 rim fire, 1863. Endless models of Remington rifles, carbines, pistols and even shotguns have been made. The action has been widely imitated and was one of the simplest of single shot devices.
5. Joslyn's carbine, calibre ·54, 1855. It employed a paper cartridge and an external cap. A top lever along the comb of the stock controlled the action.
6. American target rifle with telescopic sight, *c.* 1850. The turned end of the barrel is a removable section or lead. The waxed patch was placed on this and the bullet forced into it. The "lead" was of larger diameter at the muzzle, but tapered to the exact diameter of the bore at the rear. It was also grooved similarly to the rifling and provided a coned introduction to the bore enabling the bullet to be accurately seated and swiftly rammed home.
7. Merrill's rifle, 1858, calibre ·54, paper cartridge breech loader. Lift up block system.
8. Lindner rifle, 1859, calibre ·54. A rifled musket converted to a crude bolt system.
9. Spencer repeating rifle, military model, 1860. Seven shot rim fire butt magazine.
10. Joslyn rifle, 1864. A conversion from the earlier paper cartridge model to rim fire.
11. Hall's original breech loader, 1831, percussion model. It is identical with the flint lock model of the same arm, except that the lock is modified to the percussion system.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Beragliers, and several other officers, with the rifle gun on the new construction, which astonished all beholders. The like had never been done with any other small arms. Notwithstanding a heavy wind and a high wind, he fired during the space of four or five minutes at the rate of four shots a minute, at a target 200 yds. distance. He next fired six shots in one minute and also fired (while advancing at the rate of four miles an hour) four times a minute. He then poured a bottle of water into the pan and barrel of the piece when loaded so as to wet every grain of powder, and in less than half a minute he fired with it as well as ever without extracting the ball. Lastly he hit the bull's eye while lying on his back on the ground, incredible as it may seem to many considering the variations of the wind and the wetness of the weather. He only missed the target three times during the whole course of the experiments."[1]

This ease of reloading a wet spoiled piece was rather important. In the ordinary way a rain soaked charge had to be withdrawn by twisting a double corkscrew on the end of the ramrod into the wad and bore and then scraping out the wet powder as best could be done. Usually fresh powder was poured down and fresh priming pricked through the touch-hole with a pin or pricker; the hole was then "squibbed off," wet and dry together.

Nevertheless, Ferguson's ideas were never seriously adopted. True to the old Hanoverian principle of importing cheap Germans, regiments of Hessian Jägers, accustomed to the use of the Continental rifle, were enlisted. They carried big bore cumbrous hunting weapons, extremely heavy and fitted with the hair trigger, complex sights (some were even fitted with telescopic sights), clumsy butt with check piece, patch box and crotch heel plate, typical of the German "Schützen" rifle. A company of these aliens was commanded by Colonel George Hanger (later fourth Baron Coleraine), who wrote a good little book on Firearms.[2] A few hundred Ferguson rifles were made apparently on contract and by different contemporary makers, Durs Egg, Newton of Grantham, Turner, Hirst, etc. It also appears to have been made by Continental makers, not for use in the War of Independence, but probably subsequent to the return of the Hessians.

[1] Blanch, *A Century of Guns*. [2] *To all Sportsmen*, 1814.

Ferguson, now promoted to Lieut.-Colonel, went back to the American War and raised a corps of Loyalist riflemen in the Carolinas. On the 6th of October he was surrounded by about 3000 armed backwoodsmen, his own force of militia being about 1200. He fought to the death at a point known as King's Mountain, losing some four hundred killed and wounded, and was killed himself. The engagement was a well merited triumph for the American riflemen, for they showed both great skill in marksmanship and the tactical use of dead ground to cover a converging column attack, and lost less than a hundred men in the action. There has been some tendency to exaggerate the importance of the Ferguson rifle because it was, so far as is known, the first rifle arm experimentally issued to British troops. No service rifle proper was adopted till 1800, and then it was a Baker muzzle loading rifle, a muzzle loading pattern totally distinct from the Ferguson weapon of twenty-five years before.

The fowling piece or shotgun of the 18th century shows some interesting stages of progress, but it was not until the period of 1775, when there was a general revival of interest in firearms. Improvements began to be made by gunsmiths and inventors because of the demand by the public for better pistols and better shotguns. The early shotguns were usually long single barrelled pieces, with full length wooden stocks running almost to the muzzle, a type which we know from Jacquinet's designs[1] was in existence in 1666. The sporting needs of the time were relatively simple, for game was not usually shot flying until about 1760, and the fowling piece was little more than a refined large barrelled musket. In Central Europe the game was deer rather than feather, and the sporting weapon was shorter than the French, English and Spanish models, and nearly always a large bore rifle. The hill country of the Tyrol is easier to negotiate with a short barrelled piece, and even to-day the carbine is favoured there rather than the rifle.

Until about 1760 double shotguns were rather peculiar arms, usually of the under and over revolving barrel type. They were heavy to carry and rather slow to use, and the normal type of gun was the long fowling piece of small bore, twenty-two or twenty-four balls to the pound and a barrel of about 42 ins. long with wood stock to the muzzle. As the idea

[1] Jacquinet, 1666. Quaritch reprint and Bibliotheque Nationale, where the only known copy is in existence.

of shooting flying game gained ground literature appeared,[1] and sportsmen began to demand a shorter, lighter and more manageable piece.

In response to demand—and it is very noteworthy in the history of firearms that outside demand and inventions, rather than inventions made by the gun trade, have led to the most noteworthy steps of progress—barrels were first reduced in length to some 36 ins. Then the full wood stock appears to have been reduced to the conventional half stock or fore-end, and shortly the side by side double barrel sporting gun makes its appearance.

We may take it that the popular transformation took about twenty years to establish itself, for in 1788 Magné de Marolles published his *Chasse au Fusil*, which appeared in English as *An Essay on Shooting*, anonymous, within a year. This still treats of the single barrel as the normal piece, but nowhere alludes to the double barrel as an universal or new development. It touches on Nock's Patent Breech, which was patented in 1775, and consisted of a funnel or sugar-loaf shaped cavity connecting the touch-hole with the powder chamber. This device had considerable vogue and lasted as an improvement until the middle of the 19th century. We find, too, that the common flint lock had been improved with anti-friction rollers to the pan cover steel, that gold-lined flash pans were in vogue and the refinements born of the duelling pistol had been applied to the fowling piece. This, in the hands of Nock, Twigg, Egg and Manton, all famous pistol makers, now took on a new importance. Double barrel guns were made with the barrels side by side, separated by small lumps. In the earlier specimens there was neither top nor bottom rib, but about 1780 the top rib appears and is followed shortly by the bottom rib and with the barrels soldered together for their whole length. The last detail to change is the drop and curve of the stock. Prior to 1800 this has a certain shortness and chubbiness, but soon the genius of Manton altered the shape, so that his guns of 1805–1825 are to all intents and purposes the same as those of to-day in shape and dimension of stock.

Early double-barrelled shot guns in good condition are relatively scarce because they were not simply relegated to the attic as obsolete, but were passed on to gamekeepers, gardeners, and even to the lowly work of crow scaring so long as they would work. They had an economic

[1] *The Art of Shooting Flying*, by T. Page, Norwich, 1766.

application up to the limit of their utility, and were rather worn out than left to become curiosities.

One of the most interesting collectors' arms is a hammerless flint lock sporting gun, a few of which were made about 1730 by Stanislaus Paczelt of Prague, in Bohemia. In these arms, one of which is in the Tower Armouries and another in the author's collection, the flint is held in a bolt impelled by a spiral spring and housed in the rear section of the hollow barrel. A wedge-shaped steel is hinged in the barrel and externally fits flush with it. This overhangs a channelled priming pan cut across the rear face of the breech plug and the arm thus has a *central fire touch-hole*. In the author's specimen a further peculiarity is noticeable. A very thin steel thimble has been brazed into the muzzle as an internal liner to the barrel. This is the first known specimen of the principle of a "choke" or restriction at the muzzle designed to concentrate the pattern of shot pellets thrown from the arm, an invention usually attributed to Pape, of Newcastle, during the late 19th century. The concealed spiral spring driven flint headed bolt is cocked by a trigger or lever projection in front of the normal trigger. The scear engages in slots in the tail of the bolt and the arm is not ungraceful or badly balanced. The brass mounts are engraved with hunting scenes and show figures in the costume of the early 18th century.

Hammerless pieces do not seem to have attracted the attention of early inventors and are extremely rare, though in 1775 a patent[1] was taken out by Henry Nock, William Jover and John Green for a new fire lock in which "the lock is fitted in the stock and entirely concealed. The pan is made waterproof and the smoke from the priming carried off by a tube in the stock." Several of these pieces are in different collections.

The last quarter of the 18th century shows very marked advances in general design. Pistol barrels became solid, octagonal and accurate, locks were vastly improved and a great deal of experiment was carried out to find the best shape of steel, the right fall of the hammer, and details of shape and fitting, to render the arms more weatherproof and more reliable.

By 1790–1800 the duelling pistol is a very perfect arm, well sighted, weighty and, above all, practical. The silver fittings of the past, which,

[1] No. 1095.

however beautiful, might yet help to guide an opponent's eye, now yield to plain blued steel; even the ramrod tip becomes horn instead of brass. The action of the locks is exquisite and their action swift and reliable.

About this time, even in pistols, the full wood stock stretching to the muzzle begins to recede to the half stock and a metal lower rib carries the ramrod pipes. This feature, and with it the spur trigger guard and hair trigger, first appear in the French pistols of Boutet of Versailles, about 1785. These French arms, though beautiful, were not as practical as the English duelling pistols, which were admittedly the best in the world.

In Germany and Austria the Kuchenreuter pistols were the most celebrated. There were several makers of this name famed for the excellence of their work. Their pieces had usually folding leaf back-sights and frail hair triggers. The stocks were curiously flattened so that the grip was a long narrow oval in section. This practice is noticeable on the celebrated Lazaro Comminazzo pistols of the early part of the century, and spreading from Italy to Austria, was later over-accentuated by the Kuchenreuters and other expert makers.

The locks and stock of the Kuchenreuters were not thought much of in England, and it is very noticeable that travellers bringing a pair of these celebrated pistols back with them had them restocked and fresh locks fitted by the superior British craftsmen, such as Jover or Mortimore, Wogdon or Egg.

The wars with France and America stimulated the demand for arms, and we find many patents for ordnance and small arms. One of the most noticeable of these is that of John Waters[1] for spring bayonets attached to pistols, etc. These are common on blunderbusses and pistols of the period subsequent to the date of the patent, 1781, and are curiously seldom found attached to pieces of earlier date, though in some cases they have been fitted to earlier pieces. We also find in 1789 the first patent for single trigger locks for double arms.[2] Single trigger pistols, with side by side, and also under and over barrels, were made by Egg about this time, and are remarkably beautiful little pieces of work.

Joseph Manton's first patent appears in 1792[3] and introduces the

[1] Pat. No. 1284. [2] James Templeman, Pat. No. 1707. [3] No. 1865.

" break off " breech, into which the barrel fits with a lump instead of being secured by a tang and screw as previously used. He also cuts away the side of the breech so that the lock can be placed nearer to the centre of the barrel. Both these important features are typical of Manton's work and were later widely copied. He also introduced in this year a spring to prevent the trigger shaking and to keep it in contact with the tail of the scear.

A very peculiar type of flint lock, of which very few specimens exist, was patented by George Bolton in 1795. This lock contains no screws and has all its members supported between two side plates and has an internal enclosed tumbler. It is simple and efficient and is probably the earliest attempt to provide a military arm whose lock members are made to gauge and are mutually interchangeable. It was evidently tried by the authorities, but probably abandoned on the score of expense. These specimens that exist are all made by Henry Nock and bear the G.R., Crown, Broad Arrow and Tower mark. It is probably the rarest of all British Service flint locks and is apparently not mentioned by any of the early writers. It was, however, made in sufficient numbers to be definitely classed as a separate type, and not simply as an experimental or individual model.

Self-priming devices such as powder reservoirs attached to the pan cover or steel occupied the attention of a few inventors and fewer practical gunsmiths. Breech loaders differing in no wise from the earlier types were again reinvented and the Ferguson rifle was apparently allowed to drop out of sight, and a return to the earlier Willmore system was apparent in the 1795 arms of Hirst and other makers.

In Ireland the duelling habit was good for gunmakers, and some very fine work was turned out in Dublin from parts made in London and Birmingham. Wogdon appears to have been the favourite maker for duelling pistols, although he was a London gun maker.[1] There is, however, one type of essentially Irish weapon deserving of note, for I have not seen the type anywhere else. These are muzzle loading flint lock revolver blunderbusses, probably made for coach defence and used against

[1] Wogdon's case was the favourite precedent of the Irish Bar at this period. It is not found in law books, but only in duelling literature. " Wogdon's Case " was a synonym for an appeal to the field of honour.

the native Irish murderers who have a racial habit of working in relatively large gangs and firing from behind walls; a regrettably low standard of professional courage when compared with the ordinary lone highwayman of the English roads of the same period. These arms were made by Hall and Rowell of Dublin, and Mully of Dublin, and would seem to be about the date of 1760, but may be rather later.

They have either brass or steel flared or bell-mouthed barrels and a revolving cylinder with four chambers of about 20 bore some 6 ins. long. In one piece there was a gate provided for loading, in another it was obvious that the only way of loading the cylinder was by successively charging each chamber down the barrel.

The locks are peculiar, having an internal hammer, and the pan has to be reprimed for each successive shot. They must have been extremely dangerous to use, as it is obvious that they were meant to be used with buck shot or a scattering charge. The flash at the cylinder and barrel joint would inevitably fire the contents of the other chambers, when the whole arm would blow to pieces.

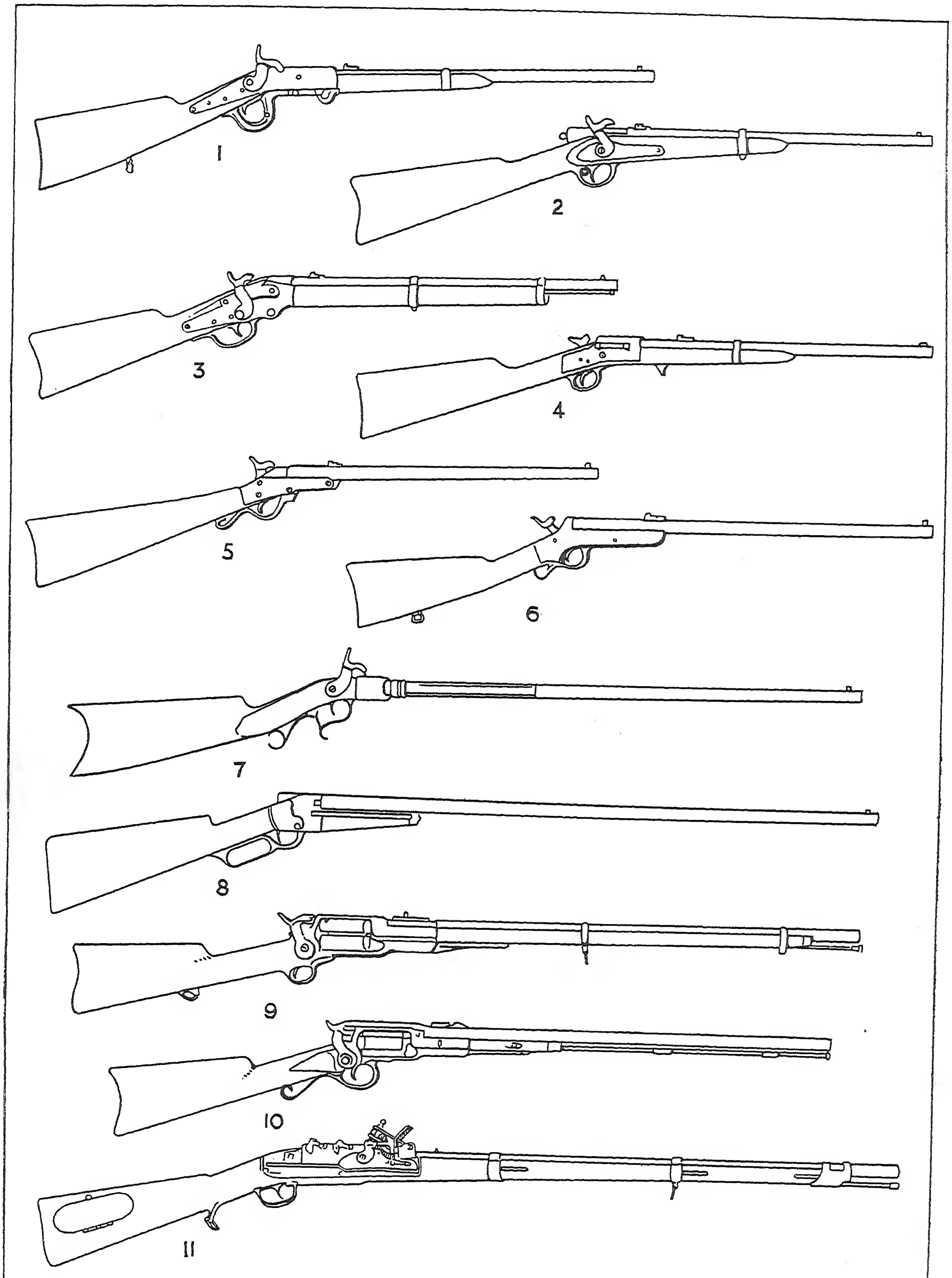
The rebellion of 1798 led to the disarmament of Ireland, and the English gentlefolk were obliged to deposit and register their personal arms at Dublin Castle. Arms so registered were engraved on the barrel with a number and the letters D.C. (Dublin Castle). Pieces marked in this manner are often found in collections, but as the Act was in force for some years it is only of relative value in dating pieces and indicates that the piece is prior to 1798.

The close of the 18th and the beginning of the 19th century brings us to a period where the records of progress are very much more common. Patent rolls, directories, and the far greater output of literature all help us to find the date of a given named piece with far more precision. It should be borne in mind, though, that the name on a piece is not necessarily that of the maker, and that with the common pocket pistols in particular, the name engraved on the arm is often that of a retailer, who may have been simply an ironmonger or a silversmith and not a gunmaker at all.

The gunmaker is something of a multiple personality at the best of times, for, in point of fact, an arm is seldom made by any one man. It is the work of barrel maker, lock maker, spring maker, stocker, mounter,

EARLY AMERICAN BREECH LOADERS

1. Burnside cartridge breech loader, 1856. The lever operating the chamber block has a toggle action wedging the chamber to the coned barrel face. The cartridge was a metal thimble with a pierced base to admit the flash of a cap separately seated on an external nipple.
2. Palmer-Lamson bolt action carbine rim fire, ·44 calibre. The bolt has an interrupted screw at its rear end.
3. Ball's breech loading carbine, 1863. A tube magazine repeater. The lever trigger guard operates the action.
4. Warner's carbine, 1864. Rim fire, ·44 calibre. A hinged block type akin to the Snider.
5. Maynard carbine, 1851, calibre ·50. Used a perforated brass cartridge and an external cap, but was later modified to take central fire ammunition.
6. Sharp and Hawkins' carbine, 1859. Not to be confused with Sharp's rifle. Rim fire, ·56 calibre.
7. Tap action breech loader, *c.* 1860. A revolving cylinder can be moved by rotating the trigger guard. The charge is fired by an external cap on a nipple on the moving block.
8. Weaver musket, 1855. The under lever cocks the hammer and frees the breech, so that the barrel can be pivoted laterally, as in later Colt Derringers. A paper or pierced metal cartridge was used, and Maynard's tape primer ignition system was incorporated.
9. Colt muzzle loading revolving rifle. Military model, 1850, calibre ·56. Note the side hammer and ramrod lever as different from the early Paterson Colt of 1840. Paper cartridge.
10. Colt muzzle loading revolving rifle, sporting model, calibre ·36. Paper cartridge.
11. Early flint lock repeater, *c.* 1815. This type of arm fired superposed charges by moving the lock back to a new touch-hole along a ratchet bar. Arms on this principle were made as match locks, and the idea occurs from the 16th century onwards. This piece was probably of Belgian manufacture exported for the American market.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engraver and even more specialists. The gunmaker himself was usually one who had served an apprenticeship to the trade and knew how to execute most of the work of the various departments and how to finish and repair the complete weapon. He was, in a word, the master craftsman who supervised the whole and often put the finishing touches, but it is a mistake to regard an arm as the handiwork of an individual. It should be looked on as the work of his particular school or shopful of skilled craftsmen.

CHAPTER V

MUZZLE LOADERS OF THE 19TH CENTURY

TWO centuries had passed since the devising of the flint lock, and though minor improvements had been applied to the details no change of principle had occurred. Then in 1807 Alexander Forsyth patented the detonating or percussion principle, in which a chemical compound which would detonate and give fire under a blow was used, not as a substitute for the propellant gunpowder, but as an ignition agent to replace the flint and steel spark.

It is undoubtedly the most important invention in firearms since the discovery of gunpowder, for it is in itself the main principle which has permitted us to proceed to the evolution of the metallic cartridge, the effective breech loading small arm, and all the varied artillery inventions of to-day.

The Forsyth principle still holds good; we use it in every military and sporting cartridge to-day and in most artillery and shell fuses. It is used in the vast industries of mining and quarrying, and has undoubtedly exercised a direct influence on the whole development of nitro-compounds evolved as by-products of work originally done on problems connected with explosives and now applied in myriad industries of peace. It can be definitely classed as one of those pivotal inventions which open the way to a whole host of minor advances, and it has materially influenced the fate of nations and the history of the world.

The properties of the metallic fulminating salts had early attracted the attention of the scientific or philosophic minds of the late 17th century. Thus we find in Pepys.[1]:—

"At noon to the Coffee House, where, with Dr. Allen, some good discourse about physick and chymistry. And among other things I telling him what Dribble, the German Doctor, do offer of an instrument to sink

[1] *Diary*, November 11, 1663.

ships; he tells me that which is more strange, that something made of gold, which they call in chymestry Aurum Fulminans, a grain, I think he said, of it put into a silver spoon and fired, will give a blow like a musquett, and strike a hole through the silver spoon downwards, without the least force upwards; and this he can make a cheaper experiment of he says with iron prepared."

About the same period we find the Fellows of the Royal Society amusing themselves with powder testing and loading a hollow steel ball with the said Aurum Fulminans.[1] They all appear to have escaped injury, but to have early concluded that the fulminates were too violent for use as propellants.

It seems strange that the application of the fulminates for ignition purposes should have been delayed for over a century, but pure fulminate of gold, silver or mercury detonates so rapidly that it will scatter loose black powder without igniting it.

Forsyth rather stresses the use of mixtures of compounds in his specification, and there is little doubt that the oxymuriate of potasse, that is to say, potassium chlorate, which had only become known during the last half of the preceding century was a very important element in his recipe. Fulminate and chlorate together make an excellent cap compound. Used by themselves they are of less value.

The Reverend Alexander Forsyth, minister of the parish of Belhelvie, near Aberdeen, took out his patent in 1807, and it is particularly to be noted that his original lock was a self-priming repeating mechanism, not the subsequent cap, tube, or pellet applications of the detonating powder principle.

He was not the first of his cloth to take an interest in inventions for firearms, as there is some support for the tradition that the late 17th century Augsburg wheel lock rifled pistols were designed in accordance with the ideas of the Bishop of Munster of 1663, to take long small calibre conical brass or copper projectiles. With such arms His Grace's guards could have perforated any cuirass or armour of the period, and it is probable that their arms were rifled. Forsyth abandoned his living to float a company, and in 1812 we find Forsyth & Co. established as London gunmakers.

[1] Birch, op. cit., Vol. I.

Points of his specification are as follows:—

"Instead of permitting the touch-hole or vent of the pieces of artillery, fire arms, mines, chambers, cavities, or places to communicate with the open air, and instead of giving fire to the charge by a lighted match, or by flint or steel, or by any other matter in a state of actual combustion applied to a priming in an open pan, I do close the touch-hole or vent by means of a plug or sliding piece, or other fit piece of metal or suitable material or materials so as to exclude the open air, and to prevent any sensible escape of the blast or explosive gas or vapour outwards, or from the priming or charge, and as much as possible to force the said priming to go, in the direction of the charge, and to set fire to the same and not to be wasted in the open air. And as a priming I do make use of some or one of those chemical compounds which are so easily inflammable as to be capable of taking fire and exploding without any actual fire being applied thereto, and merely by a blow, or by any sudden or strong pressure or friction given or applied thereto without extraordinary violence; that is to say, for example, the salt formed of dephlogisticated marine acid and potash, which salt is otherwise called oxymuriate of potash; or I do make use of such of the fulminating metallic compounds as may be used with safety: for example, fulminating mercury, or of common gunpowder mixed in due quantity with any of the before mentioned substances, or with an oxymuriate salt as aforesaid, or of suitable mixture of any of the before mentioned compounds . . . and the manner of priming and exploding which I use is to introduce into the touch-hole or vent or into a small and strong chamber or place between the said touch-hole and vent, and the plug or sliding piece, or other piece with which external communication with the air is cut off, a small portion of some or one of the chemical compounds before mentioned. . . . And when the required discharge is to be made I do cause the said chemical compound or priming to take fire and explode by giving a stroke or sudden and strong pressure to the same . . . and the discharge accordingly follows."

In practice two types of Forsyth lock were made. The one customarily applied to guns consisted of a revolving magazine fitted so as to move round a plug or nipple projecting from the arm in the place usually occupied by the touch-hole. One side of this revolving piece was a magazine tube holding some twenty priming charges of the powder.

The opposite end was occupied by a spring striker or piston. The magazine was twisted round the plug so that a charge of powder fell into a recess in it, and then the magazine was turned back through 180° round its pivot so as to bring the spring striker above the powder charged hole. The blow of the hammer drove the pin or piston into the detonating powder and exploded the charge.

This form was not very safe, as the powder would occasionally explode from the friction. This was an awkward rather than a dangerous happening, for the neck of the magazine was not closed except by a horn or wood plug which could be easily blown out if the reservoir exploded.

The improved form fitted to pistols is mechanically very much superior. In this a link connects a magazine which is free to slide on rollers along a bar, to a peg-nosed hammer. The act of cocking brings the magazine over the touch-hole to drop its powder in, and when the hammer falls the magazine is pushed back to its original position, exposing the powder-filled cavity into which the nose of the striker or hammer falls.

The new detonating principle was at first only a fad. The use of a loose detonating powder was dangerous and objectionable, and there was no real proof that a detonator shot harder or better than a good flint lock. The advantages of the percussion system, if not of Forsyth's mechanical application of it, was, however, obvious, and inventors swiftly set to work to make the handling of the detonating powder safer and simpler.

The original Forsyth lock became widely known as the "piston lock," and the term "à piston" is still applied to strikers in nipples by Continental gunsmiths. The early arms of Lepage of Paris show attempts to use loose powder or perhaps the grains of detonating powder evolved by Pulat of Paris, in 1818, but the most important advance was the enclosing of the powder in a separate copper tube about as thick as a fine match stem. In Manton guns[1] these were sometimes carried on the nose of the hammer, and driven, by the fall, down a wide conical touch-hole or nipple. In others the tube was laterally inserted down the normal touch-hole and crushed laterally by the nose of the falling hammer.[2] Some tubes were

[1] Pat. 3985, 1816.

[2] Manton, 1918, Pat. 4285 ; Fox, 1820, Pat. 4427.

provided with attachments for extracting, others with screw blocks to fit the hammer nose. There were many variations, mostly brought out with the idea of getting round somebody else's patent.

The detonating powder, the detonating pellet, the paper cap or patch lock with powder between the two paper surfaces and all the tube variants at last give place to the ordinary copper or metal cap, the real original inventor of which is not known. The copper percussion cap is not definitely alluded to in the patent records till 1823, but appears to have been invented about 1814 to 1816 by various different people to whom the same idea occurred. Col. Hawker, who is very reliable, and who disliked the invention as compared to the old flint locks, writing very close to the time, says[1]:

"The copper cap is now in general use all over the world and therefore many gun inventors attempt to claim its invention as their own. I do not mean to say that I was the inventor of it—probably not—but this I must beg leave to state:—When Joe[2] (Manton) first brought out his detonator in Davies Street he made the most perfect gun I ever saw; and doubting whether such another could be got, I set my wits to work in order to simplify the invention. At last the plan of a perforated nipple, and the detonating powder in the crown of a small cap, occurred to me. I made a drawing of it and took it to Joe. After having explained it he said he would show me something in a few weeks time, when lo and behold, there was a rough gun altered to precisely my own plan—his factotum, poor old Asell, informing me that the whole job was done from my own drawing. Thus Joe, who led the fashion for all the world, sent out a few copper cap guns, and I know with some degree of reluctance. The trade, finding that he had then deviated from his own patent, adopted this plan, and it proved to answer so well that we now see it in general circulation."

In general the student of firearms will be safe in taking 1825 as the period during which the percussion cap came into universal use on private arms. The conservative element still clung to flint and "best guns" in flint continued to be made for certain old customers as late as 1857. Flint lock trade guns for Africa are still made both in Birmingham and

[1] Colonel Peter Hawker, *Instructions to Young Sportsmen*, 5th ed., 1825.
[2] 1818, 27 Davies Street, Berkeley Square.

Belgium, but so far as fine arms were concerned they were obsolete by 1850, and none were exhibited at the Great Exhibition of 1851.

A great number of flint lock arms of all types were subsequently converted to the percussion system. Others were made with alternative breechings and locks permitting the use of either system. The traveller who might find difficulty in getting supplies of caps abroad preferred to adhere to the old flint lock. Sir Richard Burton, on his journey in disguise to Al-Modinah and Mecca, selected flint locks with Damascene barrels in preference to the percussion arms.[1] He also notes that "the arms of the Badawin of the Hijas at this date were matchlocks and flint locks preferably with good old long barrels seven span long." The price of these varied from two to sixty dollars and they were often heirlooms. "Pistols," he says, "have been lately introduced into the Hijas, and are not common among the Badawin. The citizens incline to this weapon as it is derived from Constantinople. In the Desert a tolerable pair with flint locks may be worth thirty dollars, three times their price in England."[2]

The Albanian type of Oriental flint lock with metal butt was part of the equipment of the Turkish irregular forces of Albanians of the period, and it is probable that the spread of the pistol took place via Albania to Turkey, and so throughout Arabia. Pistols appear to have been seldom used in the East prior to 1800, and all earlier pieces are customarily of European workmanship. All Oriental pistols are practically valueless to collectors.

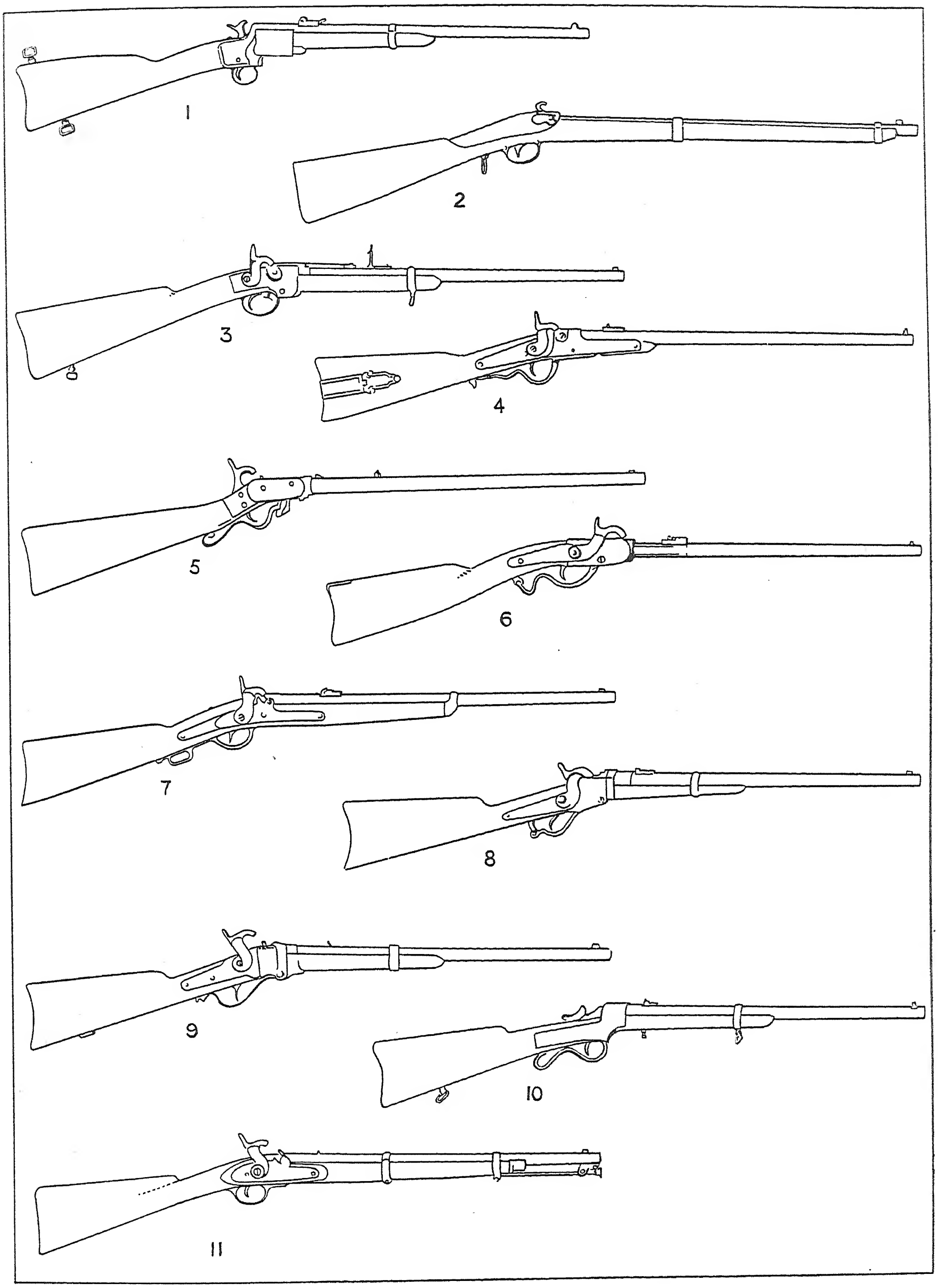
We have, as we have seen, a period in the 19th century in which flint lock arms alone are made. This may be taken as covering the first decade of the century. The second decade shows the crop of odd detonator systems which precede the stabilisation of design achieved by the percussion cap. From 1820 onward we have the conversion period, where flints were converted to percussion cap, and the flint principle was losing ground. As usual the pistol led the way because it was a weapon of greater personal importance than either fowling piece, rifle or musket. So much depended on the reliability of one's pistols on the field of honour that though a sportsman might cling to flints for his fowling piece his pistols would necessarily be detonators of the latest type.

[1] Burton, *Pilgrimage to Al-madinah and Mecca*, 1855.

[2] Burton, op. cit., Vol. II, p. 105, Bonn ed.

AMERICAN CARBINES

1. Scott and Triplett's magazine carbine, 1864. The magazine passes through the butt, revolution of the barrel round a horizontal axis brings the chamber before the loading gate over the trigger guard.
2. Jenk's Navy carbine, 1838. This early arm was used in the U.S. Navy. The hammer was set to strike sideways and access to the chamber was by a top lever operated bolt.
3. Smith's carbine, 1856. This fired a rubber cartridge ignited by an external cap. The action is that of a hinged barrel type breaking midway across the chamber. A spring operated by a stud in front of the trigger held the action in the closed position. Later modified to the Crispin carbine.
4. Gallagher's carbine, 1860. A paper cartridge breech loader with a hinged barrel operated on a link motion by an under lever.
5. Perry's carbine, 1860. Pierced metal cartridge fired by external cap. The under lever operates a pivoted chamber which is wedged to the rear cone of the barrel.
6. Union carbine, 1862. Similar to the "Perry," but also cocked by the lever.
7. Gibbs' carbine, 1856. The under lever pushes the barrel forward and disengages it from the breech; it is then depressed and exposes the chamber for loading.
8. Starr's carbine, 1858. Falling block action very similar to the Sharp's rifle, but without the cartridge cutting edge to the face of the block.
9. Sharp's carbine, 1846, calibre ·54, paper cartridge, external cap. This, one of the very earliest of the breech loaders, was also one of the best, and when later altered to take central fire metallic cartridges, became a very famous weapon celebrated for accuracy and reliability. The word "Sharpshooter" has been added to our language by this weapon. An under lever operated a falling block which moved vertically in a stout action case. In the paper cartridge models the front edge of the block shaved off the paper base of the cartridge as the action was closed. The escape of gas round the breech was a noticeable fault.
10. Ballard's carbine, 1861. First made for a paper case, it later became one of the earliest of central fire metallic ammunition rifles. Had a reputation for accuracy and some usage in British colonies.
11. Merrill carbine, reconverted from an early breech loader to a percussion muzzle loader of conventional design. It did not pay to turn some types of early paper case breech loader into a metallic case weapon, but as simpler weapons a market could be found for them. They were converted therefore into marketable muzzle loaders requiring no special form of ammunition.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The percussion cap system was no quicker than the tube locks which preceded it, but, as the cap closed the vent of the nipple and checked gas escape, it was thought by some people that the recoil was increased. The flint lock, with its relatively larger open touch-hole, permitted a considerable escape of gas at the breech. This was a defect, but at the time it was held to be a virtue, as the flint gun recoiled less than the detonator. We find the earlier percussion cap locks fitted with a platinum disc below the nipple. This is pierced with a tiny needle drilled hole communicating with the breech and was meant to provide a vent or gas escape similar to the old flint touch-hole. It gradually fell into disuse and is seldom found on arms subsequent to 1835. It is not found on tube locks, for, in most of these, the force of the explosion blew the tubes out of the touch-holes and permitted almost excessive gas escape.

The relative virtues of the two types were vigorously disputed, but there is no doubt that the percussion type was materially quicker to fire than the old flints. This delay of a fraction of a second or so was not important in game shooting, but in duelling it was vital.

The duelling pistol of 1800 was customarily full stocked, the wood reaching to the muzzle. A few half stocked pistols were made earlier than this by Wogdon about 1790, and by Continental makers, but in general the full stock was typical down to the close of the century. During 1800–1810 it gave place to the half stocked pistol with a lower rib beneath the barrel fitted to carry the ramrod. In some of the earlier of these the half stock was tipped with silver, but in the best arms of the best makers plain blued steel alone was used. The sights were very often silver, and about 1815 to 1825 the saw handle was very popular, both in flint and percussion models. The barrels were now invariably full octagon rather than half octagon with a round barrel and a flat top.

By 1836 the standard duelling pistol[1] had a barrel 10 ins. in length, at least $\frac{3}{4}$ in. in thickness, carrying a ball of forty-eight to the pound. They would be "fitted with percussion locks of delicate workmanship fitted into a firm handle that will fit the hand comfortably." The saw handle had gone out of fashion again. Purdey of Oxford Street, one of Manton's old workmen, was recommended as then making the best locks.

[1] *The Art of Duelling*, by a Traveller, London, 1836, containing much information useful to young Continental tourists.

The back action lock had made its appearance about 1830, but was not popular. The only improvement of importance in the internal action of flint and percussion locks was the introduction of the detent, a small lever pivoted to the tumbler whose function was to guide the nose of the scear into the notch or bent of the lock. It occurs in many of the very best locks, but is not mentioned by Hawker or even mid-19th century writers. It dates from the first decade of the century, but is not common until about 1830.

The hair trigger, though a very old invention, is not found on many early flint duelling pistols except those of Continental make. It was delicate and unreliable, and, unless of the very first quality workmanship, it was extremely dangerous. It is fitted to most percussion duelling pistols and many late flint locks. Arms so equipped can usually be recognised by a small capstan screw placed in front of or behind the trigger, but this external screw is not always fitted.

The action of a hair trigger is practically that of a separate lock. The trigger itself is cocked against a powerful spring by pressing it forward until it engages with a scear. A very light pressure, a mere touch on the trigger, now frees it from this engagement and, driven by the spring, it flies up and hits the scear arm, thus discharging the main lock more rapidly, and with less disturbance of aim than the ordinary finger-operated trigger. In most arms so equipped the use of the hair trigger gear was optional, and the weapon can just as well be fired in the normal way. Many duellists preferred this to the rather tricky hair trigger whose adjustments varied continually, and whose failure provoked a misfire. The detent action previously mentioned was particularly valuable as it helped to prevent a faulty hair trigger action checking the fall of the hammer at half cock.

The spur trigger, or additional grip or rest for the second finger attached to the trigger guard, was almost essential with hair trigger weapons, as it gave an adequate support to the pistol without the trigger finger having to be used. At the very best period of the saw handled percussion duelling pistol, the trigger guard is not only fitted with the spur, but curved behind, so that the trigger finger is entirely free. The second finger grips behind the guard and the third finger grips the spur. Such a grip is extremely rigid and a weapon so held is almost a fixed pro-

longation of the firer's arm and shoots where he is pointing without conscious aim.

The disadvantage of the saw handle was that these only fitted one individual perfectly, and that fresh butts had to be shaped to the individual. Duelling declined after 1840, public opinion in England being against the practice. It continued, however, in India to the date of the Mutiny, and duels were fought in Ireland till as late as 1868. Subsequently affairs of this nature were settled at Calais, Boulogne, or even at Paris. Duels have taken place between Englishmen in France within the writer's knowledge and recollection even in the present century. Until the degrading conditions of the Divorce Court are amended, and even if they are, it is conceivable that under certain conditions the field of honour is the only venue where a final solution can be found for problems of a distressing nature involving matters unassessable by any Court of Justice.

The period of the decadence of duelling, 1840–1850, was noticeable for the production of rather short barrelled duelling pistols. These were made for service in hot countries, and India in particular, and were popular with the officials of the East India Company, and represent a special type of rather rare weapon. Most have back action locks, and very often white metal or German silver saw handled butts. The metal stocks were proof against white ants, etc.

The military arm of the period of the Napoleonic Wars of the earlier part of the century was the standard "Brown Bess" flint lock musket. The percussion cap system of ignition was in common use everywhere on all kinds of firearms long before it was adopted for the service weapon. It was tested at Woolwich in 1834. A few arms were converted to it in 1839, and it was officially adopted in 1842. Even then the replacement of flint locks by percussion arms was a slow process, and was arrested eleven years later by a complete rearmament with a new weapon, the Enfield rifle.

It should be clear though that in 1842 a percussion musket smooth bore followed on the old flint lock "Brown Bess." This latter had been standardised as having a 39 in. barrel, a calibre of ·753 (11 bore), and weighed 11 lbs. 2 ozs. The new percussion musket retained all these dimensions, but weighed 11 lbs. 6 ozs.

A good deal of confusion exists between the various patterns of military arms in use in the British service. These were so often modified for re-issue, by fitting new locks or old locks off another type of arm, that the detail variations are very wide, and little reliance can be placed on diversities of mountings. The swivel ramrod attached to the piece by a stirrup appeared about 1800, and was adapted to carbines and pistols used by the cavalry.

In 1800 a rifle was issued to the 95th Regiment, who later became the Rifle Brigade, and they were equipped with Ezekiel Baker's muzzle loading flint lock rifle. This weapon, known as the "First Baker Rifle," had a barrel of 30½ ins., seven grooves and a calibre of ·65 ins.

This reduction of calibre is of interest, for apparently other small bore arms were also in use. A 37 in. barrel smooth bore musket of ·67 was seemingly issued to artillery, and a 26 in. carbine of equal calibre to the Cavalry of 1808. Muskets of 42½ in. barrel with Baker's name on them, and a bore of ·677 are also known. The diversity of calibre was always a trouble, and very shortly (1807) the second Baker rifle was issued. This was of standard ·74 calibre to take the service ammunition and had a 30¾ in. barrel and seven grooves. A third Baker rifle with a 31 in. barrel and a calibre of ·615 and an attachment for a long sword bayonet was issued about 1830.[1]

There are further disparities in calibre which may guide the collector. The standard ·753 to ·760 in. of the Service musket was surpassed by that of the arms issued for Sea Service, and for the use of the East India Company. The arms of the latter were often of ·77 calibre, but are usually identifiable as having the arms of the Company on them. The Sea Service arms are of large bore, ·78 in., and usually of not more than 37 in. barrel. Even as late as 1845 the bore was still ·77 and the barrel had shortened to 30¼ ins.

The flint lock carbines were of two bores and many barrel lengths. Those with barrels less than 25¾ ins. long were usually of pistol bore ·65 to ·66 ins. and were for the Light Cavalry. Those of 26 and 28 in. barrel varied from full musket bore, ·76 of the Life Guards to ·72–·73 ins. used by Light Dragoons.

The percussion carbines show the same characteristics and we find

[1] This model is wrongly deemed the original by Blanch, op. cit.

Enfield issuing arms of ·65 and ·73 ins. in the same year, 1844. The rare type of ·65 calibre with a hinged spring triangular bayonet folding below the barrel was made for Constabulary service in 1835. Later a double barrelled 26½ in. barrel, ·67 calibre arm was issued for Constabulary use in 1845.

The percussion musket was mainly experimental until 1844. All sorts of flint locks were converted, different barrel lengths were tried and there is little uniformity. A scrutiny of collections affords the following list which may serve to narrow the field of search, but which cannot pretend to precision :

Barrel	36½ ins.	calibre	·77	converted F.L.,		1838.
,,	39¼ ins.	,,	·70	,,	,,	1839.
,,	42¼ ins.	,,	·75	,,	,,	1840.
,,	39 ins.	,,	·75	A.I. Mfg. Enfield W.R		
,,	39¼ ins.	,,	·75	V.R. Tower.		
,,	30½ ins. (Sapper's musket)	,,	·75	V.R. Enfield,		1841.
,,	39 ins.	,,	·75	,,	,,	1844.
,,	33 ins.	,,	·73	,,	,,	1844.
,,	30¼ ins. (Sea Service)	,,	·77	,,	,,	1845.
,,	31½ ins.	,,	·58	,,	,,	1856.
,,	39 ins.	,,	·65	,,	,,	1858.
,,	33 ins. (Sergeant's musket)	,,	·65	,,	,,	1859.

The rifled percussion arms show an even wider range of variation. The trouble with the flint lock Baker rifle had been the usual trouble with muzzle loading rifles. When the arm was fouled the bullet had to be hammered down. In 1835 Captain Berners, of the Brunswick Regiment, suggested the use of a rifle in which only the two grooves were used, and a mechanically fitted belted ball was loaded. This invention had been anticipated in the past, but was brought forward as an idea of novelty. It was not a good system, but it was practical. It got over the loading difficulty, but at the expense of accuracy. The belt caused the ball to tilt after leaving the muzzle, and it was extremely susceptible to wind effects. It was adopted in 1836 and known as the Brunswick rifle.

About 1840 the Brunswick rifle superseded the Baker model, a few of

which had been converted to percussion. The following models have been noted:

Barrel $32\frac{1}{2}$ ins.,	grooves 2,	calibre ·80,	1840.
,, $30\frac{1}{2}$ ins.	,, 2	,, ·71,	1844–1845.
,, 39 ins.	,, 2	,, ·65,	1850.

At the same time a certain number of ordinary "Brown Bess" muskets were rifled, and a few Lancaster rifles two-grooved similarly to the Brunswick, but firing a bullet which was cylindro-conoidal and fitted with lugs or ribs to fit the rifling, were issued for South African service to the Rifle Brigade, 1846–1852. Pistols for this type of ball and fitted with a capping magazine were issued by Westley Richards at the time of the campaign.

The next change was to the Minié of 1850, and it was this rifle which did excellent work in the Crimean War of 1854–1856. The history of the evolution of the Minié is of interest, for it was a French invention, and was the outcome of a long series of experiments by French officers.

The muzzle loading rifle, whether flint or percussion, had several drawbacks of which the worst was slow loading. It was essential that the large calibre round ball should fit the rifling, and although the American small bore, with a patched ball, was very effective, the principle did not work so well with pieces of European calibre. The cylindro-conoidal projectile had yet to be discovered, or rather applied. In England then, and until the date of the recent war, any problem concerning musketry was referred to artillerymen who had little interest in small arms, and no experience of the needs of infantry in the field. Every European power realised that if an effective rifled small arm could be produced, it would make a great difference in warfare. They knew that it would certainly treble the effective range of musketry, but, at the same time, they dreaded having to teach their troops anything new. The British researches were accordingly fruitless.[1] The French, on the other hand, actually had a proper Infantrymen's School of Musketry at Vincennes, and there is no doubt that they treated the whole problem of small arms with far more serious consideration than we did. Always at the back of their schemes we can trace the idea of mass production of standardised interchangeable componented arms. The wars of Napoleon finished with a complete dis-

[1] W. Greener invented a very good expanding bullet in 1835, but it was ignored by Woolwich.

organisation of the armament. Poor stuff of the revolutionary era, captured arms, hasty recent manufactured pieces, all contributed to give a disconcertingly high percentage of misfires, wild shots and other troubles. The lock was amended,[1] but the French flint lock muskets, from 1816 to 1839, differed only in detail from the standard model of l'An IX which is to all intents the same weapon as the 1777 model. Rearmament began in 1816, and detail modifications occurred in 1822, 1825, 1829 and 1836. The percussion system was not adopted till 1840, and there is little doubt that the general sudden change from flint to percussion of all the Powers was inspired by fear of a great European war in 1840.

The French had experimented with the percussion system when it was in the pellet or loose powder stage. As soon as the cap was introduced about 1821 the military prospects of the system were of course vastly improved, but it was not until 1826 when, for the first time, infantry officers were represented on a Board dealing with the choice of an infantry small arm, that the percussion principle was accepted as the basis of future armament. It is worthy of note that, in the first percussion arms submitted, the first, the Charroy musket, was a self-capper, while the second, the Bruneel, used a muzzle loading cartridge in which a detachable cap was made up.[2] In 1840, when matters seemed to be coming to a head, the arms issued were simply conversions of the existing flint lock or new muskets with a back action lock designed by Colonel Poncharra. The smooth bore system was still the main armament.

The French had, however, been forced to improve on their ordinary form of musket for one form of active service, for however adequate it might be for ordinary European warfare, it was outclassed by the long barrelled guns used by the Arabs of the revolted North African colonies. In 1837 the tirailleurs were issued with the rifled Delvigne-Poncharra carbine, sighted to 250 metres. The Delvigne rifle had been invented in 1826, and was simply a reversion to the old 17th century system of a constricted powder chamber smaller in diameter than the bore. A loose soft lead bullet was dropped down the barrel till it rested on the ledge of the powder chamber. A few stout blows with the ramrod than expanded the soft metal so that it filled the rifling. The process, of course, deformed

[1] Cotty, *Mémoire sur la Fabrication des armes portatives*, 1806.

[2] Botet, op. cit, p. 35.

BREECH LOADING REVOLVERS

1. French under hammer pepper pot revolver by Lefaucheux, *c.* 1850.

1A. French rim fire pepper pot revolver by Flobert, *c.* 1850.

2. Remington muzzle loading single action pocket revolver, converted to take ·32 rim fire metallic cartridges by the process of boring all the chambers clear through and adding a pierced breech plate to admit the firing pin added to the hammer nose.

3. Unknown American single action revolver converted from muzzle loading. A fresh cylinder to take rim fire cartridges is introduced, yet the loop of the frame beneath the axis pin and the long proportion of the cylinder show the original type of the arm.

4. Pin fire smooth bore pepper pot ·32 calibre, *c.* 1860. These odd pocket pistols were popular on the Continent. An extractor rod which can be unscrewed and used to eject fired cases pierces the butt.

5. Pin fire ten shot, ·450 calibre, Lefaucheux Army type revolver, 1870.

6. Le Mat breech loading revolver, *c.* 1870. This curious arm was made for the French marines. It has a central barrel for buck shot and a surrounding cylinder and rifled barrel for the 11 mm. or ·450 Continental cartridge. A movable hammer nose permits choice of charge. (Mr. S. Haseldine's Collection.)

7. Central fire double action revolver, *c.* 1885, showing the charge from the pin fire model (No. 5) to the modern central fire system. As in the earlier pin fire model, no top strap connects barrel to standing breech.

8. Modern pin fire pocket revolver. These arms are still made in very low grades and find a sale in cheap markets.

9. The first Webley breech loading revolver, *c.* 1865, ·30 calibre rim fire, a copy of the earlier model tip-up Smith and Wesson. The arm has a curiously broad thumb piece to the hammer and rachet rifling.

10. A muzzle loading Tranter revolver converted to take ·44 rim fire cartridge. A new cylinder and hammer are fitted, and the old loading lever has been modified to an ejecting rod, *c.* 1870.

11. Remington ·44 calibre six shot breech loading solid frame revolver, *c.* 1873.

12. Smith and Wesson solid frame ·22 pocket revolver, *c.* 1860.

13. Webley-Scott British Service ·455 Mark VI revolver, official revolver for the Great War. Future official issues of revolvers or pistols for Service use in the British Army are to be made at the Government factories at Enfield. The arm is a break-down self-ejector model with stirrup lever top fastening operated by a thumb lever.

14. Bland ·38 calibre self-ejecting pocket revolver of Belgian make. The hammer nose is recessed to grip the top lever bolt and act as an additional locking device.

15. Tranter's patent self-ejecting ·455/476 Service revolver, *c.* 1875. This introduces the thumb lever now used in the Webley revolvers, but in place of a stirrup locking a projection of the top strap to the top of the standing breech, the lever engages a single dog catch on the left hand side of the top strap. Most of the design is embodied in Webley's later models.


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the bullet, and its inaccuracy of flight was remarkable. It was, too, of smaller bore than the service musket, and lacked striking energy. The old long barrelled Arab guns were still better. To supplement the rifles a proportion of the troops were, in 1838, issued with wall pieces or rampart guns—*une véritable artillerie de main*,[1] sighted to six hundred metres. The combination of carbines and wall pieces was, however, useless. At length Delvigne realised that it was question of projectile rather than weapon which needed improvement, and, in 1841, he adopted a cylindro-conoidal ball with a hollow base. Other inventors had now grasped the idea that some method of expanding a bullet without deforming it was the solution of their problems, and Colonel Thonvenin invented the principle usually attributed to Captain Minié.

Thonvenin, still using round ball, screwed a pillar or anvil into the breeching of the rifle so that the powder formed a ring round a hard steel pillar on which the ball could be easily flattened. In practice this tige or anvil softened and often bent, but the arm was good enough to be adopted by the French Government in 1846.

It was a composite arm, having the reduced calibre of the Delvigne ·60 instead of .75 of the musket. The anvil or tige of Thonvenin and a cylindro-conoidal bullet evolved by Minié with cannelures and various improvements by Tamasier, who also sponsored changes in the barrel, including a greater depth of rifling at the breech than at the muzzle.

The Minié, as the weapon was generally called, was the best military rifle of its period. It had an effective range of 1000 yards, and was dangerous to 1500. It was accurate, but it had a shocking trajectory. At 100 yards the trajectory was 3 yards above the line of sight and rose to about 6 yards at 250. At 500 metres an error in distance choosing of 50 metres would result in a bullet completely missing a target the height of a mounted man. "At 1000 metres an error of 10 metres in estimation of range would carry the ball over a man-sized target."[2]

Until this date all experiment had been devoted to the production of a mechanically fitting bullet, but the idea of using gas pressure to expand the bullet was taking shape. Delvigne states, "I made an important discovery, which was, that the gas, produced by the ignition of the powder,

[1] Duc d'Aumale, Zouaves et Chasseurs à pied.

[2] Leon Mares, *Les Armes de Guerre*, 1867.

rising into the vacuum formed at the base of the bullet, expanded it and forced it into the grooves.[1]

Minié, experimenting with the Delvigne bullet, filled the base cavity with an iron cup or thimble which was forced by gas pressure into the cone base and expanded it. This principle of the self-expanding bullet was adopted for the Enfield rifle in 1851, and £20,000 was paid by the British Government to Minié for the patent. The following year a committee was appointed by Lord Hardinge to consider the best type of bullet for the new arm. Many models were submitted by gunmakers, and at length, in 1853, the Pritchett bullet, a plain lead cylindro-conoidal plug with a shallow base depression, was selected. Later this was superseded by the Enfield bullet with a deeper base cavity in which a clay or wooden plug replaced the iron cup of Minié.

The Minié bullet itself was abandoned because the iron thimble frequently drove right through the lead cone, leaving the base of the bullet as a ring of lead stuck fast in the rifling.

The Prussians did not follow French design, but concentrated from about 1844 on experiments with the needle gun. This device was largely perfected by Dreyse of Sommerda, in 1831, and consisted of a cap placed either in a wad or at the base of a bullet, and in the middle of the cartridge. A long needle attached to a spring bolt, or pivoted to a hammer, was introduced through the breech penetrating the powder till it reached the cap, which it detonated against the resistance of the bullet or wad.

Needle guns of this period were muzzle loaders, and the invention was still in an undeveloped state, and its possible military application was being worked out in secret.

The relative values of the smooth bore musket and the rifle are shown by the tests made at Hythe in 1853 :—

Distance. Yards.	Percentage of hits with musket.	Minié rifle.
100	74·5	94·5
200	42·5	80
300	16	55
400	9	52·5

The basic principles of rifled firearms were not really understood at

[1] *Spectateur Militaire*, August, 1843.

this time. People invented novelties and obtained results by trial and error methods. Confusion reigned. To clear the air the Government commissioned Mr. Whitworth (later Sir Joseph Whitworth) to experiment with small arms at the Government's expense. It was apparently a choice influenced by political considerations and was something of a scandal at the time. He began in 1852, and in 1854 brought out a hexagonal bored rifle taking long mechanically moulded hexagonal conical bullets, Whitworth's patent. In 1857 Whitworth rifles were produced, but were inferior to others despite their mechanical bullets, increased twist and enhanced capacity for penetration. Some £50,000 of public money had been spent to no end, for Whitworth was an excellent engineer but lacked knowledge of small arms as weapons. Rifles with barrels to take his bullets are not rare, but the Whitworth rifling was never popular, nor was it adopted in the Army.

Despite the Whitworth affair we retained the Enfield. It had faults, but all reputed improvements seemed to have even more serious disadvantages.

The Crimean War, 1854–1856, found us short of arms. In order to meet the need we had to buy abroad; besides home manufacture we had 25,000 Enfield rifles made in America. The conditions of manufacture were not precise, and it was not until 1858 that real interchangeability of parts was satisfactorily achieved. The French entered the war with the earlier Minié with the tige, and many of their arms were hastily converted to the system by screwing a pillared breech plug into existing arms. The Devisme revolvers of the period have this tige or anvil in each chamber.

The Crimean War was the last European war in which all combatants used muzzle loaders, and may conveniently be taken as marking an epoch. Ten years later the American Civil War, 1860–1865, saw both breech and muzzle loaders in service use, while the Franco-German War of 1870–1871, the next big war to trouble Europe, was almost entirely a breech loading affair.

A new factor which was about to influence firearms design, and above all, methods of manufacture, appears between 1840 and 1850. The United States now began their great period of industrial development and enterprise, and American machine tool production methods began to

supersede the work of the individual worker. Like many important steps in the history of firearms, we see the beginning of the new movement applied to pistols first. The Colt revolver was the initiator of the new invasion, but, before passing to a study of the Colt, we must consider European revolvers of the early part of the century.

The revolving principle is as old as firearms, but it was not until the period 1810–1820 that manufacturing methods permitted sufficient accuracy of workmanship and precision of boring for a really safe cylindered or chambered weapon to be made. The revolver with multiple barrels, the pepper-box type, was always heavy and cumbersome, if safe. Weapons involving a series of revolving chambers and a single fixed barrel were occasionally made, but were never satisfactory. In flint lock days the loose priming powder in the pan of each cylinder was a permanent source of danger, for the flash of one discharge would all too easily penetrate the slightest looseness of joint, and discharge the other chambers before they were in alignment with the barrel. This introduced a further complication, for any obstruction at the mouth of the chamber, thus prematurely fired, meant a burst pistol. Nevertheless, fairly crude flint lock revolving pistols revolved on a ratchet by hand were made by Twigg, by Hunter, and one or two other makers. I have seen several specimens, and two of them had a central barrel round which a group of other barrels could be rotated to meet a common hammer and top flash pan. The first shot, independent of whichever barrel of the cylinder was uppermost, fired the central barrel as well. In one of this type the central barrel or pivot had another fixed barrel brazed to it along the top, and the surrounding barrels were shortened to form true revolving chambers. I am inclined to think that these arms were not made by the makers whose names are on them, and that they represent an unknown London trade workshop which made a few of these arms, possibly as novelties for general retail sale by gunshops.

The true flint lock revolver is the very rare weapon made by Collier about 1820. A good deal of obscurity still exists about this man. According to American authorities,[1] he was one Elisha Collier, an American, born in Boston. He could find no market for his arms there, and came to Europe, patenting his weapon in England in 1818, and in France in 1819.

[1] Sawyer, *Firearms in American History*, Vol. II.

In 1850 he apparently returned to Boston. His name does not appear in Colonel Hawker's list of London gunmakers, which is extremely accurate. He made a very remarkable weapon both in revolver pistol and in revolving gun or fowling piece types as well, and had a shop at 45 Strand, London. His cylinders were bored for him by Mr. Evans, engineer, of 114 Wardour Street, Soho, in 1821–1822, and he had a patent of 1820 for a percussion arm on the same principle.

The Collier pistol was a true chambered revolver, but smooth bore, although he also made revolving arms of the carbine type with rifled barrels. The hammer pan and the steel were on the top strap connecting the barrel and standing breech. The cylinder revolved on a central axis below, and had the mouths of the chambers deeply chamfered in order to admit the cone end of the barrel and eliminate gas escape. A flat coil spring kept the cylinders pressed against the barrel, and the coning would help to provide a relatively true alignment. The fall of the hammer moved a small steel wedge bolt into place, between cylinder and frame, so that the arm was firmly locked at the moment of firing.

The weapon was distinctly in advance of its time, and in some specimens a self-priming device is fitted to the pan cover. The percussion models do not appear ever to have been made for caps, but for some type of pellet magazine rather like those favoured by the French gunsmiths of the period.

Contemporary with Collier and his flint lock we find Lenormand of Paris making a percussion revolver pistol with double action hammer, and a five chambered cylinder serving a single barrel. Devisme of Paris, and Herman, of Liège, produced closely similar weapons, but with a cluster of separate barrels, at the same time. The period of 1820 to 1835 was not a war period and the revolver appears to have been considered rather a small bore toy than as a serious weapon. It was, so to speak, a pocket novelty of ingenious design rather than a weapon. The early revolvers were relatively frail, woefully inaccurate and were made in Britain by engineering concerns rather than gunsmiths. The duelling pistol of the same period was an incomparably superior weapon.

The military, or officer's pistols, were modifications of the duelling type, but shorter in the barrel and larger in the bore. Pocket pistols, a necessity of the times, were also of relative large calibre, and the usual

well-made under and over type of small pocket percussion pistol was probably a more efficient arm than the early revolver. It was more accurate and, above all, more compact. The revolver, in its early pepper-box form, whether with separate barrels or simply as a block of chambers, was bulky, weighty, and represented a poor compromise between a big-bored service, or self-defence arm, and a small calibre toy. If it was made of big bore, its weight, size and bulk were prodigious, and it must be remembered that the average of calibres of this period was large. The $\frac{1}{2}$ in. bore duelling arm was considered too small for military use, and the bore of the early revolver (an average of ·36 in.) was contemptuously dismissed as impractically small.

The records of the Patent Office throw remarkably little light on the early development of the revolver. It is probable that the common elements of ratchet rotation, and all the simpler factors of design, were already known to be in existence and unpatentable. Even prior to Collier we find Pauly in 1814 (Pat. No. 3833) covering a compressed air ignition mechanism suitable to firearms and revolvers, and it was, by the way, one which also involved the central fire principle.

Colt's early specification of 1835 claims the ratchet motion, locking the cylinder and central fire position of the nipples as particular points of his specification. In 1837 we find a specification communicated under the name of Moses Poole for a revolver with a wheel-shaped cylinder on a vertical axis. This may have been either a Cochrane or a Porter revolver, both American arms using this principle. Cochrane's first American patent was in 1837, Porter's in 1832.

The early European revolvers seem to have been nearly all trigger operated "double action" weapons, with no provision for ordinary cocking or single action use. They consisted of a block of chambers with nipples set at right angles to the bore. The pull of the trigger rotated the block and lifted a bell-cranked hammer against the compression of the mainspring until the scear automatically disengaged itself and the hammer fell.

In some cases a barrel was added to the chambers, in others these were made, not as a block, but as separate barrels screwed to a common multi-nippled breech.[1] In the latter specimens the hammer is usually

[1] Mariette's system, 1838.

below the action in front of the trigger guard. A few specimens of revolvers, in which the lifting of a thumb operated hammer revolves the cylinder, exist, but these, with the probable sole exception of Baker's pistol, are all probably subsequent to the popularisation of the Colt pistol of the 1847–1850 period.

The defect of the early European revolvers was their inaccuracy. The long heavy trigger pull, the lack of sights, and the very fact that in most types the hammer was actually sited in the line of sight made them impossible arms for use at anything but the closest of close quarters. The tradition of their inaccuracy endured for years after the revolver had become an arm capable of considerable precision, and one still finds people firmly convinced that revolvers "throw up" to such an extent that it is essential to aim at a man's boots to hit his chest!

The self-cocking pistol of European design was apparently hardly known in the United States, for Colt did not know that the revolving principle was an age-old European idea until he visited England in 1835. Ethan Allen, another eminent American arms designer, patented in the U.S.A. in 1834 the double action mechanism which was already a well established principle over here.

The American arms were, however, made by people who wanted revolvers or pistols for actual use, and their designs were better and very much more practical than those of European makers, both British and Continental, who made weapons of limited utility for a less practical market.

Samuel Colt was a man of astonishing energy and vigour. He was not only an inventor and designer, but an organiser of first-class ability. His first arms were made in 1836. He was at the time only twenty-one years of age, but had been able to form a joint-stock company to initiate the enterprise. "The first arms produced," says Sawyer,[1] "were pistols (revolvers). The greater part of them were of pocket size, with folding trigger and no trigger guard. Being a distinct departure from anything familiar to firearm users they did not at once become popular. . . . Dealers in firearms, however, shortly found a ready market for them in Texas, which, in April of 1836, had won independence of Mexico. . . . Because almost every one of this model of 'pistols' went to Texas, in

[1] Op. cit., Vol. II, p. 15.

COLT REVOLVERS

(*See Appendix on Colt Arms for details.*)

1 The rare Paterson Colt with the folding trigger. These arms were made at Paterson, N.J., from 1836–1842. The distinctive feature is the folding trigger and the absence of a loading lever, ·36 calibre. (Sir Frank Crisp's Collection.)

2. Colt Dragoon or Holster Pistol, 1847. ·44 calibre; weight 4 lb. 2 oz. Marked "Sam'l Colt, New York City."

3. Rare Walker model, 1839 Colt. Very similar to No. 2, but marked "Paterson, N.J." Calibre ·44. (Sir Frank Crisp's Collection.)

4. Colt Navy model, 1851. ·36 calibre. Made and marked "London and New York."

5. Colt 1855 or "Perfected" model. Made in various calibres and sizes.

6. Colt 1861, Army model. Calibre ·44.

7. Colt 1851, pocket model with reduced rear to cylinder, London make. Calibre ·36.

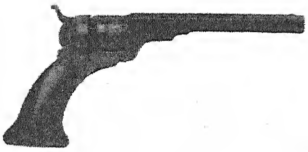
8. Colt Frontier ·45 single action breech loader of 1873. The most popular Colt revolver ever made.

9. Colt pocket revolver, converted from ·36 muzzle loading to a central fire ·38 arm for metallic ammunition. Date *c.* 1870.

10. Bisley Colt ·455, British, *c.* 1885. A variant of the Colt Frontier with a deeper, more curved butt, a refined hammer and a wide spoon trigger. Designed for target use, it only achieved moderate popularity.

11. Colt Dragoon ·44 muzzle loading type of 1847. Essentially a heavy military arm, a few of these weapons were used by mounted volunteer forces in the closing stages of the Indian Mutiny.

12. Long-barrelled Colt 1851 pocket revolver, with extension stud at side to take a detachable stock. Calibre ·31.



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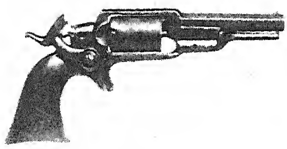

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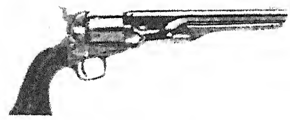

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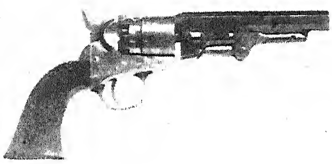

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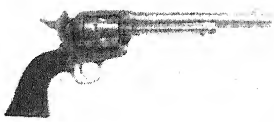

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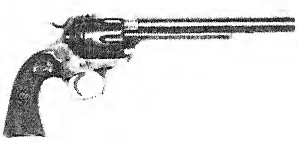

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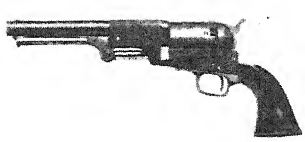

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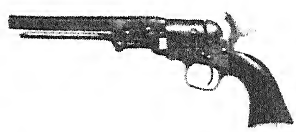

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after years Colt referred to them as the 'Texas' pistol, and the name stuck "

In 1841 the original Colt Company, which had made these arms at Paterson, N.Y., failed, and in 1842 it closed for ever. The Company had made two main types of pistol, the " Texas " pistol, which was made in many sizes and calibres, and the " Walker," suggested by Captain Walker, of the Texas Rangers. This weapon had the loading lever and a trigger guard, and was better adapted for rigorous service use. Colt pistols of early manufacture are of considerable value and interest to American collectors.[1]

Four years later the United States went to war with Mexico, and everybody wanted Colt revolvers, which were not to be had. Government support was forthcoming, and in 1847 Colt began to manufacture at Whitneyville. (Arms made there were stamped New York.) Shortly afterwards he established his armoury at Hartford, Connecticut, where it endures to-day.

In 1851 Colt came to England, and was invited to read a paper on Colt revolvers before the Institute of Civil Engineers. He stressed his methods of machine production, his capacity for vast output, and the point that all parts were interchangeable. Colt also decided to put up an English branch, probably foreseeing the coming of a European war. He procured a factory at Thames Bank, Pimlico, and brought over, in 1852, duplicates of his special American machinery. The factory opened in 1853, and produced replicas of his standard pistols marked on the barrel " Address Col. Colt, London." In 1854 the Crimean affair, beginning as a joint move by France and Britain in support of the Turk, somewhat unexpectedly turned from a proposed military promenade into a war. Colt caught the next ship over to find that we did not want Colt revolvers,[2] but that we wanted more Enfield rifles than we could produce. The new London factory was equipped for pistols but not for general work. Colts' imported American foremen, but they could not handle British work-people, and the whole place was disorganised. Colt went back with a big

[1] See note in the Appendix.

[2] " All needed Colt revolvers," Sawyer, op. cit., p. 35. The eminent American authority is, I fear, in error on this point. Nobody wanted revolvers, but Colt got a contract through with the Russians later.

order for Enfield rifles, which were made at Hartford. He returned to England in the autumn of 1854, and went over to Russia, where he booked a revolver contract, the execution of parts of which was sub-let to Belgians. The Russians were, I fancy, more interested in commissions on contracts than deliveries of arms—a trait we noticed in the late war—and long before any Colt revolvers were adding to the horrors of war the war stopped. Some few hundred Colt revolvers were delivered in time to be used during the Indian Mutiny,[1] but Colt revolvers never were adopted as an official weapon in any British service.[2] Colt, on the other hand, appears to have supplied a great deal of arms manufacturing machinery (much of it bought in England) to various foreign Governments. He was a master spirit of the type we became familiar with during the boom period of war contracts. With the outbreak of the Civil War he began a period of intense activity, but died, not altogether unexpectedly, early in 1862, having made over five million dollars in fourteen years. Whatever his success as a business man or his failure in other respects, he deserves credit for having made and popularised a very excellent revolver.

The output of Colt, London, was mostly confined to the standard Navy model and the pocket pistols. The first was a 7½ in. barrel six shot single action revolver of ·36 calibre (84 bore), weight 2 lbs. 10 ozs. It was also made in other barrel lengths and occasionally with refinements of sights. The pistol was fairly popular, but never enjoyed in England or the Colonies the same degree of service popularity as the double action English models of Adams, Tranter and other makers.

The factory also marketed, but I do not think made in Britain, a very limited number of the extremely heavy 1847 Model Army Pistol, a 7½ in. barrelled six shot revolver of ·44 calibre which weighed 4 lbs. 2½ ozs. This terrific weight limited its utility, and specimens meant to be used as a hybrid carbine with a detachable stock are known. It is a rare arm.

The pocket pistol was made in three calibres, ·36, ·34 and ·31, and

[1] Supplied to the Poona Irregular Horse.

[2] The Colt ·455 revolver and ·455 automatic pistol were used to supplement regulation arms during the Great War, the automatic being the regulation pistol of the Canadian Expeditionary Force. All Colt issues have now been withdrawn from the service.

barrels varied from 4 to 6 ins. It was invariably a five chambered arm and was made in enormous quantities.

The Colt factory also sold and advertised revolving rifles and carbines, but it is doubtful if these were not imported, or at least only finished here. In all, Colt's invasion was not a success and the London factory was closed in 1857. The relics were taken over, and a small company appears to have used up the surplus of parts as "The London Pistol Company," a name I have seen impressed over an almost obliterated London Colt stamp. They later patented an improved model in 1859, but the business failed.

The excellent Colt pistols made a deep impression on our English makers, and between 1848 and 1851 our own makers made great advances. The exhibition of 1851 shows Lang, Rigby, and T. R. Cooper, of Birmingham, a famous revolver pistol maker of the time,[1] exhibiting revolvers. Robert Adams, the inventor of the solid frame revolver,[2] is not represented. Tranter and Philip Webley, both subsequently great revolver makers, do not appear as patentees until 1853.[3] The Webley was a single action arm with a big hammer and is extremely rare.

The Adams' revolver may be taken as the best representative of English design of the period. It was a weapon which was mechanically far superior to the Colt, but which lacked something of the grace and balance of the American competitor. It was, however, both stronger, for it had a solid frame similar to the best of modern practice and since adopted by all American makers, and it had double action, so that it could be used as a trigger operated self-cocker as well as self-cocked by thumb pressure. The backsight was on the frame, a marked advantage over the Colt design, where a rough notch in the hammer nose served as a backsight. It was also of adequate calibre, ·45 in., and a more powerful weapon than the Navy Colt of ·36 calibre of equal weight.

It was adopted by the Small Arms Committee and issued as the regulation arm, and was also selected by the East India Company as their cavalry arm. So good was the design that it endured alteration to the breech loading principle and remained the standard solid frame arm until the breakdown self-ejecting principle superseded it.

[1] 1849, Pat. 12,781. [2] February, 1851, Pat. No. 13,527.
[3] Tranter, Pat. No. 212 ; Webley, Pat. No. 305, 1853.

No records exist, but it is probable that the Adams' revolver had a far greater distribution throughout the British Empire than any similar weapon. It was the standard revolver for India, Australia and the African Colonies, first as a muzzle loader, then for another twenty years in its breech loading form.

Muzzle loading was so unassailably established that at the Great Exhibition of 1851 we do not find a single breech loading cartridge weapon shown by any British firm. Specimens were, however, shown by Lefaucheux, Flobert, Pecare and Smith, of New York, and other foreign exhibitors.

Reviewing the arms producing world of 1855 as a whole, we find that the English shotguns and sporting rifles were the best in the world for reliability, shooting qualities and workmanship. Our duelling pistols were famous, and our new revolvers were rapidly challenging the supremacy won by Samuel Colt's genius as a master of publicity and salesmanship. Our military rifle was a poor weapon, but it was not very seriously inferior to the arms of all other first-class powers. French arms as a whole were no longer held in great esteem, except for the perfection of artistic work lavished on the very best Parisian weapons. Germany had not yet developed her industrial resources, and the quality of her wares was not equal to other European States. Spain had sunk into civil wars, and the state of Italy was little better. Madrid, Toledo and Brescia alike all seemed to have dropped from the list of gun-making cities. America was to the fore with new ideas, "notions," but, with the exception of Colt, there was no sign of great production by the new machine methods. Belgium was a mass producer of cheap material, but no serious rival to Birmingham.

The English gun trade was perhaps almost at its zenith as regards world trade and general prosperity. There was neither restrictive legislation nor were there heavy protective tariffs to be faced. Wages were low, supplies of raw material were cheap, and the skill of the workers had not yet been deteriorated by machine-shop methods. The average of actual craftsmanship was high, and the proportion of hand work to machine work was still extremely heavy. Prices were low and a pair of best guns by a good London maker would cost with case and accessories fifty guineas the pair. The introduction of the breech loading principle

materially added to the cost of all arms by introducing more labour, and, above all, more skilled labour for accurately fitting hand-made parts together. Breech loading marks not only an advance in principle, but the end of a definite economic era, and brings us to the point where machine work to a greater or lesser degree annihilates hand workmanship.

The early revolvers show the first application of engineering rather than gunsmith's principles of manufacture to firearms.

The Colt and Adams' revolvers have been taken as instances of type, but there were made during the last decade or so of the muzzle loading period a very great number of pistols and revolvers of different patterns. They did not, so far as most of them were concerned, contribute much of value to the progress of firearms in general, but principles were often applied first to the pistol weapon before being tried on guns or rifles. The smaller arm too was more suited to the machine-shop methods of the day, and did not involve an extensive plant.

The United States show an astonishing diversity of firearms, many of which are very quaint. The eccentricities were often the outcome of the need for avoiding somebody else's patent, and there seems to be little doubt that the patent laws of the U.S.A. at that period, or perhaps their interpretation in legal circles, was peculiarly harassing to the inventor.

Some of these arms, both revolvers and carbines, show how long it was before the alternatives to the copper cap were routed. The copper cap had a serious rival in the Maynard strip primer, which was perhaps the best attempt at a magazine priming device. It endures to-day in a modified form as the roll of " caps " used in repeating toy pistols. For the real arm the strip was of a fairly waterproof composition, and the percussion powder charges incorporated in it were far heavier. It achieved a measure of popularity in Africa, but in the U.S.A. it was officially adopted. The U.S.A. service rifles were being altered to the Maynard primer system when the Civil War broke out. Alternative weapons, using a flat paper cap or disc amorce fed from a magazine, were also favoured in the South, probably from French tradition centring at New Orleans.

In England self-capping devices were tried again and again, but never really found favour. They belong more to early experimental percussion days, and then, after a lapse, to early experimental breech loading days,

than to the fixed era of percussion arms from 1825 to 1850. The Westley Richards device of a magazine of caps beside the barrel, so arranged that one could be pulled forward and pressed down on the nipple by a snap bolt, was the only one which was much used. Others seldom got beyond the patent specification and experimental demonstration arm stage.

It is curious to note that, though there is no firm in England now making revolvers (with the exception of Webley, whose arms do not call for extensive survey until breech loading times are reached), Colt's early rivals, Smith and Wesson and Remington, are still in the field as makers of arms. Others have been submerged in the various great arms manufacturing concerns in the U.S.A., and have lost their identity. There are no Colts in the modern Colt Firearms Mfg. Coy., but the family of Wesson still control the Smith and Wesson firm.

There were two Wessons, Edwin the elder, and his brother Daniel, both workmen at Allen Thurber & Co., gunmakers of Norwich, Connecticut. Ethan Allen was the inventor and manufacturer of the American type of pepper-box revolver with the double acting hammer. Charles T. Thurber was his brother-in-law, and, after a period of small beginnings, when they made, in 1834, saw-handled rifled duelling pistols, walking stick guns, etc., they established the Norwich factory in 1842, moving to Worcester, Massachusets, in 1847. The firm then became, in 1857, known as Allen and Wheelock. In 1865 it was known again as Ethan Allen & Co., and in 1873 it changed to Forehand & Wadsworth, sons-in-law of the original partners, and, as the Forehand Arms Co., incorporated in 1890, it is still in existence making arms for one of the big mail order houses of the United States.

Ethan Allen built the first metallic cartridge factory in the world in 1860, and carried it on till 1872, when it was sold to the United States Cartridge Co. of that time. The metallic cartridge made at this factory gave a marked impetus to American firearms inventions, and may, in some measure, account for their popularity.

Daniel Wesson was born in 1825, and worked for a while in the Allen factories and other local concerns. In 1849 he went into partnership with Smith, and in 1856 began to manufacture repeating breech loading pistols and breech loading revolvers. The earlier muzzle loading

revolvers manufactured by them were "Leavitt's Patent." In these arms the cylinder was turned by hand. They date from 1837 to 1850.

The elder brother, Edwin Wesson, also made some firearms inventions, and became the founder of the Massachusetts Arms Company. Conflict with Colt over patents restricted the production of the Company, but they avoided some of the restrictions and manufactured a large number of revolvers used in the American Civil War. These had no nipples on the cylinder, but each chamber was pierced with a pin hole which came opposite a nipple on the breech, which could either be recapped for each shot or was automatically fed with Maynard's tape primer.

The multiplicity of percussion muzzle loading revolvers is very noticeable. Very few were entirely hand made, and certainly most of the American arms were mainly machine-tool productions. In addition to the revolver the Americans produced a peculiar short barrelled small pocket pistol known as the Derringer. These were made by Derringer of Philadelphia, and were like small duelling pistols, but deeply rifled, and with very short barrels. In some the bore is reduced toward the chamber so that bullets of different gauge could be used. They were muzzle loading percussion arms, but the name has now been transferred to breech loading Colt, Remington and other big bore pocket pistols of non-revolving system.

List of Muzzle Loading Percussion Revolvers and Pistols of the Middle of the 19th Century

Adams, J. Double action, usually five shots, various calibres, from ·32 to ·45. British, but also made by Ames Arms Co., Chicopee, Mass.

Allen & Thurber. Pepper-pots, and single barrelled pistols with the same kind of top hammer and double action. Grafton, Mass., 1837–1842. Norwich, Conn., 1842–1847. Worcester, Mass., 1847–1856.

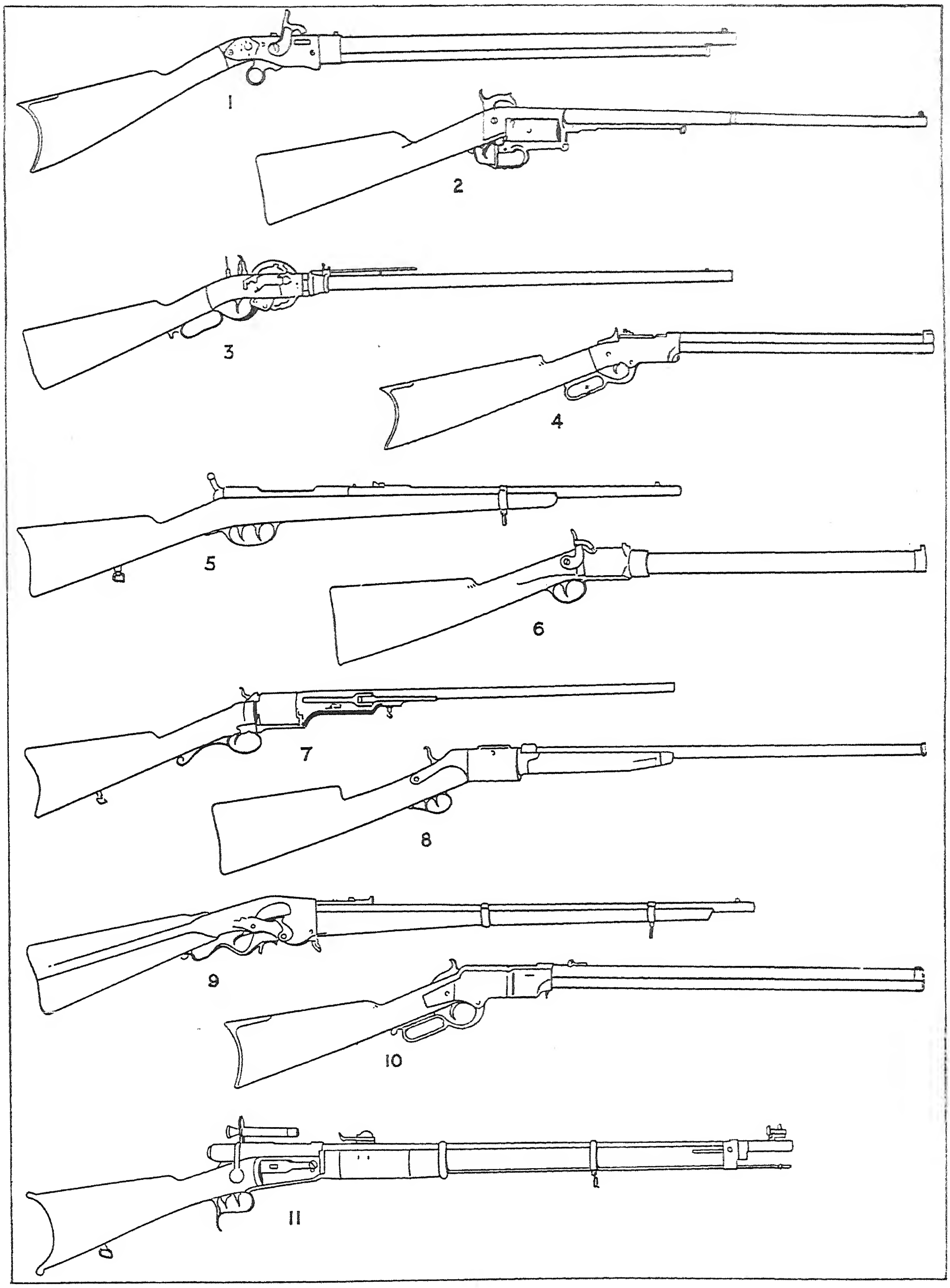
Allen & Wheelock. Solid frame revolvers with the pepper-pot type of hammer, and also service revolvers with a single action hammer situated at the side of the action falling obliquely on the chamber nipples. 1857. Many variations.

Alsop, C. R. Calibre ·31, Navy revolver, single action, six shot. Middletown, Conn., 1860. Several patterns.

Ames Arms Co. See Adams, T.

REPEATING RIFLES

1. Jennings' rifle, a breech loading paper case repeater of 1850, calibre ·54. The charge was relatively small and the arm held sixteen or more charges.
2. North repeating rifle, 1850. A shield covers the top of the cylinder.
3. Porter's repeating rifle, 1851. The radial cylinder takes eight shots. The hammer is lateral and complex sights are fitted. Similar to Noel's and other European systems on the radial principle.
4. Volcanic repeating rifle. Smith and Wessons' patent, 1854. This arm is the predecessor of the Henry and the later Winchester rifles.
5. Brown repeating rifle. An early stock magazine model.
6. Multi-barrelled Belgian goose gun. Six small bore rifled barrels enclosed in a tubular external case are fired simultaneously. Variants with Remington type of action and block or charger loaders have also been made.
7. Colt "Paterson" revolving rifle with lateral loading lever. Early model, about 1842. The common Colt rifle has a side hammer like the Colt 1855 model revolver.
8. Roper repeating shotgun, 1866. Four shots 20 bore.
9. Evans' thirty-two shot repeating rifle, 1871. The butt magazine was on the Archimedean screw principle.
10. Henry magazine rifle. Predecessor of the Winchester, but with a different type of magazine. Note the catch in front of the action at the base of the magazine tube.
11. Swiss Vetterli magazine rifle, 1870. These were fitted with telescopic sights. The official model used rim fire bottle-necked cartridges, but those used by rifle clubs used central fire steel cartridges which could be reloaded at the firing point.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ANCION. 1851, Liège. Pepper-pots with separate barrels.

ANDREWS & OSBORN. Similar to the above. This type of arm was largely made in Connecticut and Massachusetts from 1850, and was probably made wholesale by the Quinebaug Rifle Co., of South Bridge, Mass., and finished by smaller concerns. Calibres range from ·31 to ·42, and the barrels are rifled.

ASHTON, P. H. Single barrelled pistols with an under-hammer and trigger rather like a cane gun. The stocks are almost at a right angle to the barrels. Known as "leg pistols."

BACON ARMS CO. 1863, Hopkins' Patent, ·31 revolver, Norwich, Conn. For the later model of 1866 the cylinder is on a swing-out principle, similar to the modern Colt.

BEALS, 1856. Revolvers manufactured in quantity by Remington. Small revolvers with an external lifter to the cylinder, ·36 calibre.

BEATTIE, T., 1850, London. Very heavy 44 calibre pepper-pot pistols of the best make. Revolvers with spring-loading plunger.

BERRY, 1850, Poughkeepsie. Maker of Cochran revolvers with radial cylinder and under nipples fired by an under hammer. These weapons have been found in England as "Wilkinson" revolvers. Rare.

BERTONNET, 1850, Paris. Early saloon pistols, muzzle loading, a cap on a nipple axial with the barrel providing the only propellant charge. A later variant provides for breech loading of the pellet.

BOYD, 1861, Montreal, Canada. Pepper-pots and similar variants.

BUTTERFIELD, T. S., 1855, Philadelphia. ·44, Army revolver, fed by a repeating primer magazine, holding disc or "paper cap" primers; this is operated by the single action hammer and caps each chamber as it aligns with the barrel.

CHERRETT, D., 1851, London. Two grooved hammerless rifle pistols. Internal centre fire lock.

CLAUDIN, 1845, Paris. Finely engraved pepper-boxes with elaborate ebony stocks. One of the finest makes of duelling pistols and the very best luxury arms ever known.

COLT. See appendix on Colt arms.

CONNECTICUT ARMS CO., 1864, Norfolk, Conn. Made Wood's patent revolver, calibre ·31. It had the tip-up action later associated with the early Smith & Wesson breech loaders and the earliest Webleys.

Cooper, T. R., 1843, Birmingham. A large variety of small pepper-pots and revolvers of similar make. Most were the familiar double action, but single action models are known. In a model of 1851 the top hammer is set slightly to the side to afford a line of sight. Made largely for the general gun trade. Later pepper-pots and revolvers have a sighting slot pierced through the hammer.

Daw, Witton & Co., 1849, London. Very good double action revolvers of all calibres. The barrel is not connected to the standing breech by a strap as in the Adams, and the dismounting system is similar to the Colt.

Deane, Adams & Deane, 1851. See Adams.

Derringer, Hy., 1840, Philadelphia. Single shot muzzle loading Derringer pistols of large calibre. They are often mounted in German silver. Made pin fire revolvers at a later date. Used the letter P as an armourer's mark on the barrel.

Devisme, 1850, Paris. Under hammer pepper-pots and under and over enclosed lock hammerless pocket pistols. The large military revolver has a side hammer but no loading lever. The chambers each have a pillar or tige breech plug.

Dreyse, 1850, Sommerda. Needle fire muzzle loading revolver with double action trigger operated bolt action. Specimens now very rare.

Egg, H., 1851, London, successor to Durs Egg. Under and over single trigger pocket pistols.

Forsyth & Co., 1812–1857, London. Self-priming percussion powder pistols. No revolver on the principle known to exist.

Fowler, 1835, Connecticut. Leg-shaped percussion under hammer pistols.

Gleichauf, B., 1851, Bochenheim. Twelve barrelled pepper-box on the needle gun principle.

Goddard, S., 1850, Birmingham. Imported many American weapons.

Goddet, Paris. Four-barrelled pepper-pots with a platinum head inside the hammer.

Grey & Moore, 1847, London. Retailed various revolvers, but made two grooved rifled weapons.

Hart, B. T. 1861, New York. Like a Colt, but rather more graceful in outline of hammer. Calibre ·31.

HENDRIKS, F., 1846, Amsterdam. Four barrelled pepper-pot type revolvers, with double action hammerless type, enclosed hammer and saw handle. Calibre ·36.

HOARD'S ARMOURY, 1862, Watertown, N.Y. A heavy six-shot ·44 revolver practically a copy of the Starr in outline, but without the breakdown action for removing the cylinder. Freeman's Patent.

JOSLYN ARMS CO., 1858, Conn. Solid framed side hammer ·44 military revolvers, five shot. Used in Civil War. B. F. Joslyn's patent.

KERR, 1859, London and Birmingham. A solid frame side hammer revolver, made in many sizes. The cylinder pin withdraws to the rear. The loading lever is enclosed by flanges of metal beneath the barrel. Used by the Volunteers, 1860. It was sold in vast quantities to the Confederate States during the Civil War. Usually five shot ·36 calibre.

KUCHENREUTER, 1851, Regensburg. Overhammer inlaid and chased revolvers, with a peculiar short hammer fall and ring triggers. Only a few made for exhibitions, etc., as *armes de luxe*. Extremely rare.

LANG, T., 1847, London. Very well made revolvers of graceful type with single action side lock and obliquely sited nipples. These were proper hand-made gunsmith's work and are now rare.

LEAVITT'S PATENT, 1837–1849. Made by Wesson, at Hartford, Conn. Eight shots or six shots, various calibres. Single action cylinder turned by hand and sometimes with Maynard's tape primer lock instead of nipples. Cylinder pierced flash holes.

LEFAUCHEUX à Paris, 1820–1868. Many interesting pin fire arms, mostly breech loaders, but a few ordinary pepper-pots elegantly decorated appeared to have been made. Very early pin fire pepper pots.

LIBEAU, New Orleans. Hand-made revolvers of early design (1830) and considerable complexity. They show the influence of ordinary duelling pistol design.

LE MAT, 1860, Paris. These are peculiar revolvers with a central barrel for buckshot, calibre ·66, acting as a pivot for a cylinder with eight chambers of ·42 calibre. The hammer striker is jointed, and the rifled revolver barrel lies above the smooth bored one. Many were made for the Confederate States for a firm at Charleston, Sidell and Beauregard. It is believed that some were also made at the same

time in London or Birmingham. It was later made as a breech loader on the same principle and issued to the French marines.

London Pistol Co. Took over Colt's factory in London. Only a few arms so made.

Manhattan Firearms, 1859. Similar to Colt's, except for an intercepting member between nipple and hammer nose. Later arms are imitation Colt's of common type but with different engraving on the cylinder. Also single shot pistols with the pepper-box type of top hammer. Many varieties of arms.

Massachusetts Arms Co., 1845–1865, Chicopee, Mass., U.S.A. This company made the Leavitt revolvers under the Wesson patents which were the losing side in Colt's great law-suit. They also made the Stevens' revolver with Maynard's 1845, primer lock in 1855. It is often miscalled "Maynard's revolver." In addition they manufactured the British Adams' in 1862, and made a remarkably poor job of a first class weapon, converting it to a crude single action with a rough American type butt. Have apparently issued a variety of second grade arms of widely varying types.

Moutier le Page, 1850, Paris. First class Continental revolvers of decorative design. Celebrated for duelling pistols.

Nepperan Fire Arms Co., 1865, Yonkers, N.Y. Reproductions of the standard pocket Colts.

Newbury Arms Co., 1855, Albany, N.Y. Made a curious ·31 six shot revolver with no straps connecting barrel to lock or breech above or below. The barrel was solely supported by a square head on the cylinder axis.

North, H. S., 1856–1861. Invented the Savage revolver, in which a secondary lever or ring trigger operated by the second finger operated cylinder and action. They were big heavy pistols of ·36 calibre, and had a curious moving cylinder chamfered at the chamber mouth to receive a coned barrel base, as in the Collier and Galand types. The U.S. Government bought 5500 of these at $20 apiece for issue during the Civil War.

Patent Arms Mfg. Co., Paterson, N.Y. See Colt notes.

Percival, 1840, Orville of Moodus, Conn. Pat. 1850. This inventor produced an arm, the principle of which had been tried about 1700.

Hanging chargers to contain ball powder and fulminate pellets were held by a sleeve capable of being rotated round the barrel until opposite loading holes, when the right proportion of charge is dropped through. Thus loaded, the hanging chambers are allowed to swing back beneath the barrel. The hammer drives a firing pin into the pellet. This ingenious but dangerous weapon was able to hold forty ·32 calibre bullets, and was made by H. Smith, of Norwich, Conn., 1850, for the inventor. It is a rare arm.

Pettengill, 1863, U.S.A. Hammerless army revolvers. Rare. See Raymond and Robitaille.

Porter, P. W., 1845, New York. These peculiar arms were made as revolvers and carbines, and had a vertical radial cylinder taking three charges. The hammer placed laterally on the side of the action struck sideways rather like a walking stick gun's hammer. The arm was primed with percussion pellets fed from a magazine. Tape lock models were also made.

Prélat, 1851, Paris. Made five barrelled revolving pistols of pepper-box type.

Raymond and Robitaille, 1856, Brooklyn, N.Y. The first hammerless revolver. It was a large calibre, six shot ·44 hammerless double action weapon of heavy but graceful design. Smaller models were also marketed. The U.S. Government purchased 5000 in 1861, but they proved to be too delicate to stand the rigours of the service. Made by Roger Spencer & Co., of Oneida, N.Y., as well. Pettengill patent.

Remington, E. & Son., Ilion, N.Y., 1858. This famous firm made a series of very good revolvers on F. Beal's patents. The most familiar is perhaps the ·45 army revolver with solid frame 8 in. barrel and six chambers. Other models of ·44, ·36 and ·31 were also made. In addition to the Beal patents they made the Rider revolvers, the latter usually in pocket sizes. The solid frame and accurate workmanship of these arms was valuable when they were later converted without material alteration to breech loading arms taking central fire metallic cases.

Robbins & Lawrence, 1849, Windsor, V.C. Makers of the Leonard patent revolver. These were double action ring trigger pepper-boxes, but the barrels did not revolve; an internal revolving hammer moves

round inside a shield instead. The action breaks down to cap, and the principle is later developed in the Lancaster four barrelled breech loading pistol, which closely resembles this arm in appearance as well as the principle of the revolving hammer. They also made the Vermont muzzle loading service type rifle, all parts of which were on the interchangeable system.

Rogers & Spencer, 1860, N.Y. These makers made the Pettingill, and also a Rogers & Spencer ·44 Army revolver which is, in appearance, similar to the Remington Beal's old model, except that the loading plunger is not sheathed in wings attached to the frame.

Savage Revolving Fire Arms Co. See North.

Springfield Arms Co., 1851, Mass. Made Warner's patents and closely followed Leavett & Wesson design. Varieties wide, ranging from ·44 to ·28 calibre. In the Civil War model two triggers were used. Pressure of the forward trigger against the rearward one discharged the arm.

Starr Arms Co., 1856, New York. These were made in both double and single action, and both ·44 "Army model" and ·36 "Navy model." The double trigger action of the Warner model was used in earlier types. Later the action was hinged as in the ordinary breakdown type of modern revolver, but was secured by a pin instead of a spring catch. The cylinder and its axis pin could then be removed for clearing. Needless to say, there was no extractor.

Tranter, 1860, London. This popular revolver was a modification of the Adam's solid frame design, and had a refinement of the double action trigger, which was later applied to the Kynoch revolver. The trigger was concealed inside the top of the ordinary double action trigger. A pull on the latter rotated the cylinder, and cocked the arm, and caused the real trigger to project so that the trigger scear could be freed by light pressure. In some models the main lever trigger projected like a spur trigger through the trigger guard and could be operated by the second finger.

Walch Firearms Co., 1859, N.Y. These very peculiar revolvers were ten shot and had two hammers side by side and a five chambered cylinder. Each chamber was loaded with two charges, separated by a special grooved double bullet which served as a breech block for the

first discharge. The arm was single action, both hammers being cocked together. The trigger pressure lowered the right hammer first and fired the forward charge. A second pressure lowered the left hammer firing the rear charge. Each load had its separate nipple, and the flash to the forward one was conducted along a narrow touch-duct bored in the cylinder wall. If the first charge mis-fired, discharge of the second probably burst the arm. Several varieties exist, some firing twelve shots. Very rare.

WEBLEY, P., 1853, Birmingham and London. Single action revolvers of ·45 calibre. Extremely rare. A wide spoon-shaped thumb piece to the hammer and a slender curved stock are distinguishing points of the design.

WHITNEY, ELI, 1856, Whitneyville, Conn. Made many varieties of service and pocket revolvers used in the Civil War. In general they were solid frame weapons similar to the Remington. The patents were Beal's, whose arms were also made by Remington. In one pocket model (and a rare Army model), a spur trigger forward of the trigger guard is used to release the cylinder, which can then be turned by hand. The Army model was seven shot and ·31 calibre. Later a modified six shot Colt pattern was made. It resembled a Colt except that the barrel was joined to the standing breech by a strap across the top of the cylinder.

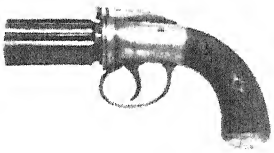
WITTON & DAW. See Daw.

The foregoing list indicates something of the wide range of machine made weapons brought into existence at the end of the muzzle loading era. In the main these were applications of the revolving principle to pistols, but it must not be overlooked that rifles, carbines, and, in some cases, smooth bore fowling pieces, also on the revolving principle, were made under the same patents and by the same firms. Colt's, Cochran's, North's, Porter's and others all made the longer arm, but the Colt was the only one made in any quantity or variety.

At the time that muzzle loading revolvers were being made, most of the firms so engaged were also making breech loading carbines or rifles. It is worthy of notice that the revolving system is really half-way to the breech loading principle. A muzzle loading revolver is in essence a chamber type magazine breech loader, and the old trouble of forcing

PERCUSSION REVOLVERS

1. Typical English percussion "pepper-pot" revolver. Double action only. Date, *c.* 1830–1855.
2. Typical American percussion "pepper-pot." A similar but cruder mechanism. The cap shield totally encloses the nipples except for the firing point and capping recess. Specimen by Marston and Knox, New York, 1864.
3. Tpyical Continental percussion "pepper-pot." This differs from other types in that the barrels are each separate and an under hammer operated by a ring trigger is usual. This specimen is by Mariette, 1850. Similar models were made in Birmingham by Cooper, and also by makers in the U.S.A.
4. Muzzle loading revolver by Kuchenreuter, of Regensburg (ex Hertford House Collection). This piece is remarkable for central fire nipples and an exquisite refinement of workmanship and decoration. Date, *c.* 1840.
5. Heavy percussion "pepper-pot" of ·45 calibre by Beattie, London. Period of 1850.
6. Early double action percussion revolver by Thomas, *c.* 1855.
7. Single action percussion revolver by Baker, *c.* 1850. This shows the development of the "pepper-pot" by a reversion to single action and the addition of a light barrel. No loading device is embodied and the rifling is deep and multi-grooved. The hammer is staggered to permit an accurate sight to be taken.
8. Double action percussion revolver by Beattie, *c.* 1854. This shows further advance. The rifled barrel is attached not only to the axis pin of the cylinder, but by a lower strap to the frame. A plunger loading rod is incorporated.
9. The first Webley revolver single action percussion. Now the rarest of early English percussion revolvers.
10. Double action percussion revolver by Deane, showing the curved hammer, the flash diverting shield over the cylinder and the spring at the side plate of the lock which holds the hammer at half-cock for capping, etc.
11. Typical "pepper-pot" changed to a crude revolver at a later date. In these the original cylinder barrel is cut short and a barrel added to the axis.
12. Adams' double and single action solid frame revolver, 1854. Here the top strap joins barrel and frame, and these were the first solid frame revolvers made. In the Crimean War they were preferred to the Colt single action and were later adopted as the British official model.



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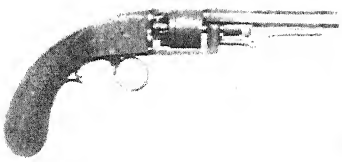

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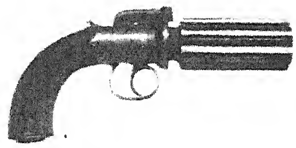

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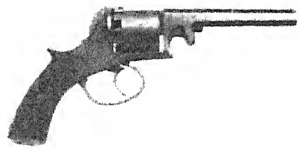

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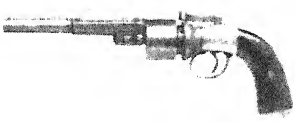

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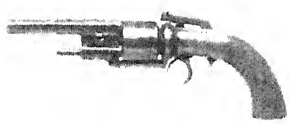

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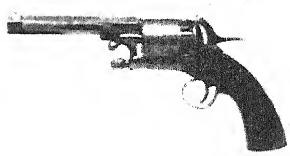

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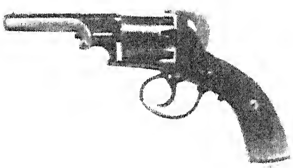

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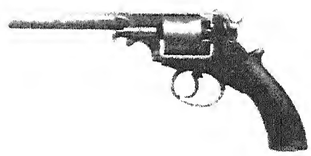

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a ball down fouled rifling is met by loading a smooth bore chamber of larger diameter than the barrel at its muzzle end. The principle was never a great success with the larger arms, for there was too much loss of gas between barrel and chamber. This does not matter in a pistol, but is of importance in the larger arm.

The improvement of machinery and machine tools soon made the average of precision with these old revolving muzzle loading arms relatively approximate to that of the usual single barrelled pistol. It is not, however, comparable with the ordinary breech loading arm of average manufacture. I have personally tried out a number of muzzle loading revolvers in good repair, and with the most scrupulous conditions of loading there are few that can be depended on to make anything closer than a six inch group at thirty yards. The legendary stories of the past wonderful shooting do not really date back to muzzle loading days, but rather to the late 'seventies and early 'eighties, when weapons were very much better and ammunition more reliable. In these and in the earlier days conflict took place at close range, and speed was more important than precision. That favourite little weapon, the Derringer, could not be relied upon at anything over twelve paces, but was excellent for use across a card table.

It is here that we must leave the muzzle loading period, closing between the late 'fifties and the early 'sixties, with Englishmen with wonderful fowling pieces, Frenchmen with graceful chiselled duelling pieces, and Americans with the new-born deadly revolver of their new history. The armies of the world carry rifled muskets of great weight and poor precision, and already in the clubs sportsmen are talking of their new breech loaders and their great convenience in the field.

CHAPTER VI

EARLY BREECH LOADING ARMS

THE success of the breech loader as an effective principle was not dependent on any mechanical perfection of the gun or rifle, but entirely on the invention of the metallic cartridge case. It is true that we still use a paper cartridge case for shotgun cartridges to-day, but this has a metal head and a metallic cup either inside or outside the paper case. It is effective with the low pressures of a shotgun, but is not suited to more powerful arms.

If we look at the whole history of the breech loader we find that it always was a fairly simple business to invent some kind of mechanical action which would permit the introduction of a charge at the breech. Under wheel lock or flint and steel conditions this loading of a loose charge was both dangerous and troublesome. The percussion cap represented an enormous step in advance for *it did away with the process of priming*.

The idea of combining the cap as a component part of the cartridge was not quickly reached in practice, but it is curious that long after the relatively excellent pin fire system had been evolved by Lefaucheux hundreds of inventors went on turning out curiously rudimentary systems employing a separate cap and peculiar cartridges.

To a latter day student of firearms the outstanding feature of the breech loading period is not the vast variety of arms, which will make it a wonderful period for collectors in generations yet to come, but the relative neglect of essential principles by the bulk of inventors. The explanation of this and many other oddities of construction can be traced to the patent mania of the period. Patent mania has not yet attracted the attention of our psychologists, but is nevertheless a specific mental disease. It can be expressed as a fixed determination to avoid the artificial restriction imposed by a fundamental patent of importance by evolving

complicated and inferior ways of doing the same thing, instead of manufacturing an improvement on the original patent.

The mid-19th century was a period of bitter rivalry between patentees. More ink was spilt than blood, but a perusal of the technical books of the period reveals a wholehearted venom that we seldom meet to-day. Manufacturers rose to heights of malice and the bitterest attacks on rival's wares.

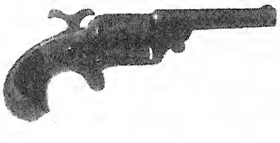
It is an interesting change from the straightforward old Colonel Peter Hawker to this era of Brummagem spite, but it shows pretty clearly why the scientists and gently bred natural philosophers of the period made a hard and definite line between the manufacturers, usually alluded to as "that ingenious mechanic Mr. So-and-So" and gentlemen interested in the history or scientific development and application of their wares. Between 1825 and 1860 writing on these subjects of applied arts and sports devolved from the leisured and interested amateur to the manufacturing classes. The result is that much of the literature of the period is purely the polemics of rival tradespeople biassed in their judgment and writing to sell their own wares.

The attempts to outwit rival patents, the suppressions of fact and the vaunting of inferior wares complicate the recorded contemporary history of firearms more than it would be possible to believe. Matters of importance to the historian of firearms were not recorded because of the furtive theft of ideas by members of the gun trade. It was a glorious period of prosperity, smugness, ostentatious church-going and bleakly paraded virtues. It will not, however, stand scrutiny on the moral side. Commercial honesty was as low as it has ever been. The theft of brains was reckoned a business virtue, and the trade as a whole must have been a dubious lot. The policy does not appear to have held the elements of permanent business success. No great firms were established upon these foundations. The big firms of London gunmakers whose history goes back to the early years of the century did not launch out into these patent snatching excursions. They did not bother with machine-made arms, big contracts and the lures of mass production, but worked solidly to turn out their best wares for their customers.

Several very peculiar phases of public interest can be noticed, but it is noticeable that the stimulus to gun inventors is invariably war and that

MUZZLE LOADING REVOLVERS

1. Moore or "Tit" revolver, ·30 calibre, six shot, *c.* 1865. This arm shows the transition from muzzle to breech loading. It uses metallic cartridges with a fulminate filled projection or tit at the base. These are inserted from the front of the cylinder. (War Museum specimen.)
2. Tranter ·450 solid frame revolver, *c.* 1860. These were among the best of English arms of the period.
3. Joslyn revolver, five shots, ·44 calibre. Date, 1858.
4. Remington-Beals revolver, six shots, ·44 calibre, 1858.
5. Starr revolver, six shots, ·44 calibre. Date, 1856. (War Museum specimen.)
6. Nepperan revolver, five shots, ·36 calibre, *c.* 1865, varies but little from the Colt.
7. Remington-Rider revolver, ·36 calibre, five shots. Date, 1858. An early pocket revolver. (War Museum specimen.)
8. Bacon revolver, five shots, ·36 calibre, *c.* 1865. An improvement on the Colt.
9. Whitney Navy revolver, six shots, ·36 calibre, *c.* 1860. (War Museum specimen.)
10. Savage Navy revolver, six shots, ·36 calibre, 1860. The ring trigger is a separate lever used to cock the hammer and rotate the cylinder. North's patent, 1856. (War Museum specimen.)
11. Dreyse muzzle loading bolt hammer double action needle fire revolver, *c.* 1850. This rare weapon used special ammunition with a detonating pellet at the base of the bullet. The firing needle had to pass through the powder charge and had to be fully withdrawn before the cylinder could rotate. The long double action bolt accomplishes this. The long lock action and the short cylinder are peculiarities inseparable from this type of action.
12. Devisme revolver, five shot, ·36 calibre, *c.* 1855. In these arms an anvil or peg on the Minié system is inserted in each chamber.



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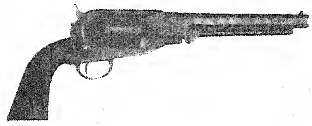

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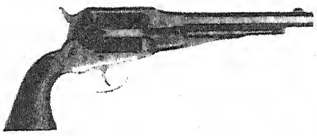

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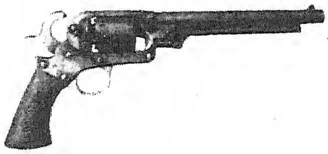

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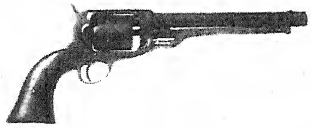

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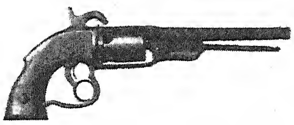

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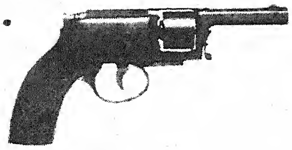

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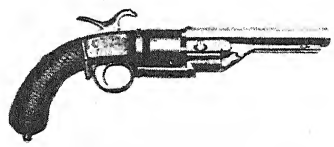

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the bulk of the progressive inventors are not people connected with the gun trade, but independent brains attracted to the problem by the illusory offer of great rewards. The Volunteer movement of 1860 suddenly brought a large number of people who had never fired anything but a fowling piece into contact with the butt end of the Enfield muzzle loading rifle. It is pretty clear that this bred universal public civilian interest in the shortcomings of the Army rifle. Public pressure rather than any military zeal on the part of the professional soldier brought about rearmament with the breech loader. The soldiers, then as ever, hated anything new, and so long as the existing arm was pretty to drill with they loathed the idea of any change. The same principle operates to-day, and the Army may be depended on to the last musketry sergeant to oppose the introduction of any new rifle. Not because the new model will be an improvement (and they will doubt that !), but because it means a new drill and instructors will have to learn new rigmaroles. The instructors will be ably supported by regular officers of equal intelligence.

It is probable that we shall some day suppress the pike and cutlass attachment, called a bayonet, by modifying it to a practical lightweight spear head. It will not pass without letters in *The Times* from many heroic physical jerks' instructors who trained recruits in the bayonet exercise before they—the recruits, proceeded overseas. But it is hardly to be expected that the traditional remnant of the "half pike" of 1645 will be abandoned without a struggle.

We find this note of the battle between progressive brains and the Army, or as the Army prefers to call it, "the authorities," as a recurring note in the history of small arms. It is the civilian who has always seen to it that our arms were not more than a decade behind those of rival and potentially hostile powers. The record of the National Rifle Association is not merely long lists of Bisley pot hunters. It is something far more valuable. Insistent pressure on inert soldiers clinging to jobs where any show of intelligence might be looked on as showing up the stupidity of their seniors has meant a great deal. If the control of arms has rested always with the "authorities" nothing but a holocaust of rank and file at the beginning of campaigns could have been expected. The amateur rifleman, the old Volunteers and the Territorials deserve the thanks of their countrymen for their work as irritants. They and their ally the Press have alone saved us

from the imbecilities of Woolwich and Enfield time and again repeated. To-day the Army technical authorities are excellent and progressive people, but they need a critical civilian public to keep them up to standard! Long may this kindly sensible opposition flourish. It is the necessary counterpoise to the soldier who is of self-protective necessity in pursuit of his career as much a politician as the raw mass of M.P.'s he so much condemns. Further it helps the progressive expert to get authority to try out new ideas.

The early breech loaders were among the first of all firearms; in fact, breech loading was one of the early principles which was reached just as soon as any inventive talent was applied to arms. The problem was always the same. The gas generated by the explosion of the powder exercised a cutting and chiselling effect on the joint of breech and barrel, and until the cartridge was invented no satisfactory method of preventing gas escape was evolved.

Mechanically the early chamber loading culverins and the haquebuts of King Henry VIII (Tower Armouries) were cartridge weapons. The separate chambers were in effect cartridges, but it must be clearly recognised that the thin metal cartridge of to-day, which is used once and then thrown away, is very different. The brass cartridge is soft and yet springy. While the powder gases in the barrel are at high pressure it is expanded, forming a gas-tight joint between breech and barrel, but once the pressure is relaxed it again contracts and allows the relatively strong first movement of the extractor mechanism to separate it from the chamber. The taper shape of modern cases aids this extraction. But once deformed by explosion it cannot be used again.

The old chamber loading pieces did not have an elastic chamber. It was usually a steel breech socket with a coned mouth held by wedge or block to the male cone of the barrel end. Alternatives were the revolving wheel, cylinders and kindred variations. In all cases gas pressure and the erosion caused by hot powder gases provoked two serious faults. There was loss of power due to the free vent of the gases, and there was so much escape of gas that the arms were difficult, dangerous and unpleasant to fire.

The same difficulties hampered all attempts to make a good repeating or magazine arm. We may take the repeating breech loaders of the time of Charles II, *circa* 1664, as types. Here we had all the mechanical move-

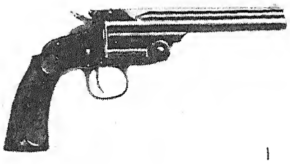
ments necessary to provide a good weapon. Modified to take a rim fire or centre fire metallic cartridge and provided with means of ejection, the Cookson type of gun is little different to any of the many revolving block type breech loaders of 1860–1870. The screw type breech block found in the Willmore and further developed in the Ferguson is not very far from the Ross half-threaded breech bolt, the Mannlicher or other bolt heads of to-day. Yet, however perfect the design of breech, it was useless until the self gas sealing device of the metallic cartridge case was evolved. After this was established, breech mechanisms became merely matters of comparative strength, ease of manipulation, and above all reliability of extraction. Little by little, small arm charges increased and calibres decreased. This meant a long cartridge, and mechanisms only suitable to short loads became obsolete. Rapidity of fire became of paramount importance, and the mechanism, which was almost an ideal single loading device, had to yield to the simple but robust repeating or magazine arm, which would hold an adequate supply of long cartridges suitable to the military needs of the period.

The dominant factor throughout late design is the attempt to evolve satisfactory military systems, and sporting rifle design follows rather than leads. On the other hand the ballistic improvements of the present century are largely the outcome of research on special problems associated with the improvement of sporting and match rifles. The shotgun or fowling piece began its separation from the musket in the latter half of the 18th century and divorce was complete by 1850. With the end of the muzzle loading period the road of development forks, and shotguns soon pursue their own path independently of the progress of rifles. They are ballistically very little superior to their muzzle loading predecessors. Smokeless powder and better barrel boring methods have affected them a little, and they are as developed as they can be within the limits of their utility. They have not, however, developed in any way comparably with that of the great progress in rifles and pistols, and there has been no serious extension of range, velocity of projectile or progress in principle. It is perhaps not seriously desirable in the interests of sport that any such improvements should be made.

The sporting 12 bore shotgun of to-day is sometimes made slightly heavier than usual and very lightly rifled at the muzzle; it is known as a

SINGLE AND REPEATING PISTOLS

1. Smith and Wesson ·22 target pistol. The modern representative single shot arm of precision.
2. French early saloon pistol. A breech block pivoted to the rear of the barrel (shown turned toward the reader) holds a cap on a nipple in a recess. The hammer is simply a cocking lever, a striker passing through the breech face causing ignition. The other side of the pivoted breech gives access to the barrel for pellet, and if necessary a small powder charge. The weapon is smooth bore and is one of the steps toward the later rim fire cartridge. Period, *c.* 1840. Earlier models had only a nipple and no breech block and were muzzle loading. (Mr. S. Haseltine's Collection.)
3. Remington ·50 calibre U.S. cavalry single shot pistol. The last of the single shot military pistols.
4. Stevens' ·22 " tip-up " pocket pistol, 1871.
5. Lancaster's four-barrelled pistol. A revolving striker fired each barrel successively. The rifling is not obvious and the arm appears smooth bored, but the bore is really *oval* and twisted so that it is in effect a two-grooved rifled weapon. Date, *c.* 1880.
6. The Colt ·410 rim fire single shot Derringer pistol. The best known of modern pistols of this type.
7. Modern ·44 calibre side lever duelling practice pistol, Systéme Devilliers, Paris. The weapon is used for wax bullet duelling pistol practice, and a heart-shaped hand shield is attached to the stud on the front of the trigger guard to protect the hand.
8. No. 2, showing the breech block closed. (Mr. S. Haseltine's Collection.)
9. Stevens' " Pocket Rifle " ·32 central fire calibre. This pistol has an attachable wire stock and was more carbine than pistol.
10. Remington ·30 calibre rim fire four-barrelled pistol. This curious pistol has a ring trigger and a long and hard double action pull which operates a revolving internal hammer. No extractor is provided.
11. Remington ·410 rim fire calibre split breech block Derringer.
12. Lancaster under-and-over double-barrelled 20 bore buckshot pistol. This arm was used in 1920 in Ireland for car defence against bomb throwers.
13. Unknown pistol, thought to be a Gardner-Colt experimental model. A tube magazine holds central fire cartridges. Trigger action draws a sliding barrel back to meet an advancing breech block with bolt action striker.
14. Woodward under-and-over revolving pistol of ·44 calibre.
15. Sharps' four-barrelled ·30 calibre rim fire pistol. A revolving nose to the hammer fires successive cartridges. The earliest breech loading pocket pistol of wide distribution, and the first generally used weapon for metallic ammunition.



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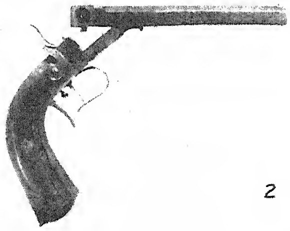

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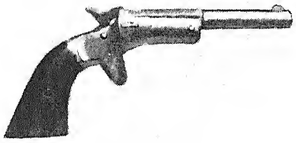

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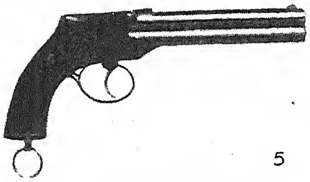

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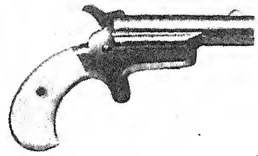

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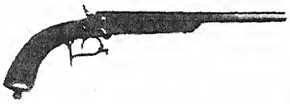

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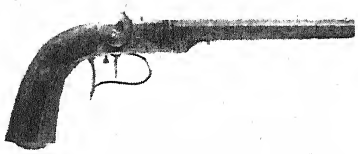

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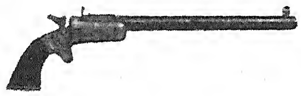

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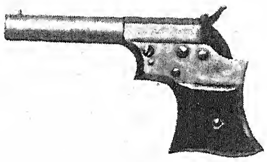

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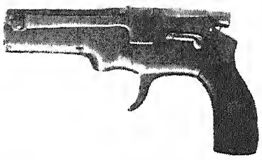

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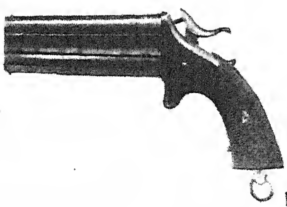

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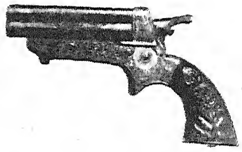

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ball-and-shotgun and is effective with ball fired from the ordinary paper case up to about two hundred yards. It is probably rather better than many of the earlier breech loading or military carbines. The smaller 20 bore ball-and-shot sporting gun loaded with equivalent ball has a rather better range. Three hundred yards is claimed for accurate fire under good conditions. This is about as effective as the muzzle or breech loading carbine of equivalent bore of the early periods, but it is not as good as the heavy twelve pound rifle of that time which could fire a heavier charge than the light double barrelled shotgun of little more than half its weight. The shotgun used with ball gives us, however, a rather useful mental standard of comparison, a lowest common denominator from whose level we can appreciate the astonishing growth of efficiency of the sporting or military rifle of to-day.

The cartridge, on which the whole success of the breech loading principle depended, was curiously slow in winning recognition. It was invented relatively early in its four distinct forms of pin fire, central fire, rim fire and needle gun. The pin fire type emerged gradually out of the Demondion cartridge of 1831, which embodied a tube detonator in its base, through a capped or rather nippled cartridge invented by Bastien Lepage, about 1840, to the true pin fire case in which a cap was embedded in the charge and was struck by a wire pin projecting laterally through the case. This in the form in which it is still used to-day, was invented by Houiller, another French gunsmith, in 1847. He also appears to have patented the rim fire and a variant of a central fire cartridge at the same time.

The pin fire cartridge is sometimes attributed to Lefaucheux, the inventor of the drop down shotgun breech action, and "systéme Lefaucheux" nowadays means "pin fire." This is not accurate, for the early Lefaucheux guns of 1836 employed a cartridge with a cupped base in which was inserted a reversed cap with a projecting central pin which was struck by the firing pin. It was in a way an inversion of central fire as we now understand it.

The rim fire cartridge evolved naturally out of the percussion cap, and was first made by Flobert of Paris, a maker of saloon arms, about 1835. The evolution can be traced from the saloon pistols, which originally had simply an exposed nipple for a cap, and fired a pellet dropped down the

barrel. Next the nipple was enclosed in a recess. A later model fires the cap on a swinging anvil, which is hinged to move sideways to facilitate extraction. Then development ceases, for the rimmed cap or rim fire cartridge had been evolved. It was common previous to 1851, and early revolving or multi-barrelled pistols began to be made about 1857 to take several cartridges of Flobert bore (·22 to ·23), but used a rather longer cartridge. In 1859 the ·300 and ·380 calibre rim fire cartridges used in the Sharp's four barrelled pistol and similar arms were made, both in Europe and in the U.S.A., where the first metallic cartridge factory had been erected.

The needle fire cartridge dates from 1830 and was patented by Adolph Moser in 1831,[1] but it is probable that this was Dreyse's patent taken out in the name of an agent. It is not till 1840 that we definitely find a breech loading needle gun cartridge patented.[2] In the same year we also find mention of projectiles recessed to contain a propellant charge of detonating powder (a system used in some semi-saloon repeating arms) and Shaw's rather quaint system of passing a cap on a rod through the touch-hole and firing it by impact against the other side of the barrel. In the needle gun cartridge a hard papier mâché wad was placed at the base of the bullet above a paper container holding the powder charge. In a recess in the wad was the detonating pellet or cap, which had to be struck by a needle which had to pass right through a perforated base wad and the whole powder charge before it reached the pellet. The system was a bad one, as it led to gas escape at the breech and corrosion or bending of the needle. There was no rim or extraction projection on the needle cartridge, and they were first evolved for muzzle loading arms. In breech loaders the debris of the fired cartridge was simply pushed further up the barrel by the next cartridge.

In 1850 Needham shifted the cap wad to the base of the cartridge, and made what was an inverted centre fire cartridge fired by a short stroke needle. In 1852 Lancaster adopted a case with a rim like the Flobert, but pinched a paper cap between the base and an internal perforated metal disc with four holes, which was held by the rim. This was the first true central fire cartridge. It is still used in walking stick gun ammunition, and "systéme Lancaster" is still the French name for this particular

[1] Pat. No. 6196, 1831. [2] Wm. Bush, Pat. No. 8513, 1840.

kind of cartridge, which has a very wide and thick rim and is not normally interchangeable with ordinary central fire cartridges of equivalent size and calibre. In 1861 Daw brought out the central fire brass cartridge we use for shotguns to-day. It was the patent of Pottet, a French gunsmith.

Reviewing the systems we find that both pin fire and needle fire systems were not gas tight and were rather dangerous to transport in quantity. The rim fire was the first and best metallic cartridge case, and the central fire at last combined the cheapness of the paper and metal case (rim fire cases of large size were originally fairly expensive) with gas tightness and ease of extraction.

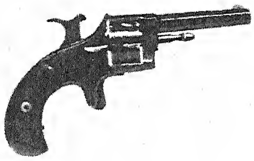
It was, however, a long time before the cartridges invented in the 'forties became generally applied. They do not really come in until the 'sixties, and it is very doubtful if inventors as a whole grasped the fact that the cartridge was not only a convenient means of loading, but also an indispensable gas check. The early percussion breech loaders were nearly all *paper cartridge breech loaders*, that is to say, they employed a charge of powder and a ball or conical bullet wrapped in a paper envelope, but it contained no means of ignition. It was fired by external means, either by a cap, tube or by a tape primer, fired on an external nipple. The flash was strong enough to pierce the paper of the case and fire the whole. The remnants of the burnt paper were not extracted, but pushed further up the barrel and fired out by the next cartridge. In some cases the paper was impregnated or nitrated, so that it would burn away rapidly. This system was dangerous, for smouldering sparks lingered in the chamber.

The first serious military type breech loader, subsequent to the ill-starred Ferguson rifle of 1776, was an American invention, Colonel John H. Hall's patent of 1811. This was made first as a flint lock, then as percussion, and is the first breech loader officially adopted by any army. The flint locks were made till 1832, the percussion model from 1831. The factory was at the Hall Rifle Works, Harper's Ferry.

The Hall rifle consisted of a plain central hammer box lock enclosed in a case behind a chamber. The whole action, lock, chamber and all, was pivoted in a box frame at the rear of the barrel. Pressure on a short lever under the fore-end lifted the chamber, which had radially grooved locking blocks on its side, so that its mouth was tilted above the barrel to receive

EARLY REVOLVERS

1. Hopkins and Allen solid frame ·22 rim fire single action pocket revolver, 1871.
2. Brooklyn revolver with sliding covers to the chambers to avoid a patent covering breech loading through a gate.
3. X.L. rim fire single action pocket revolver. A typical cheap weapon of 1890.
4. Smith and Wesson single action break down ·32 central fire self-ejecting revolver. One of the most graceful little pistols ever made. Typical of the eighties.
5. An earlier Smith and Wesson ·32 rim fire with a tip-up barrel. The rod beneath the barrel was used to eject cartridges when the cylinder had been removed.
6. Crude single action ·38 rim fire pocket revolver of 1830.
7. Early tip-up model ·44 Smith and Wesson. A military model made for or possibly in Austria. (War Museum specimen.)
8. Smith ·38 central fire revolver, single action non-ejecting. The cylinder is supported on a spring plunger axis pin and is removed for extraction of the empty cases. This early patent is the forerunner of the present Smith and Wesson solid frame side ejector.
9. A Smith and Wesson modern ·38 special revolver with swing out cylinder.
10. Montenegrin revolver of ·44 calibre. These grotesque arms take the largest known revolver cartridge. King Nicholas of Montenegro ordered that all male adult Montenegrins should carry one of these pistols. His enemies claimed that he drew a commission on their manufacture. (War Museum specimen.)
11. Merwin Hulbert ·44 self-extracting revolver with folding thumbpiece to the hammer. These weapons were too complicated to achieve success, but were very beautifully made.
12. Thomas' self-extracting ·450 central fire revolver. This was one of the earliest attempts to meet the problem of case extraction. The whole barrel rotated by a bolt handle and pulled the cylinder along in the frame. A ring on the face of the standing breech retained the cartridges by their rims. A similar device was used in the Merwin and Hulbert arm. The Thomas pistol was weak and racketty; specimens are rare.
13. An early Smith and Wesson seven shot ·22 rim fire revolver embodying the old spring half-cock device found on muzzle loading revolvers.
14. French Service revolver 11 mm. model '83, showing the removable grip giving access to the mechanism.
15. Smith and Wesson ·44 Russian single action model. (ex Walter Winans' Collection.) This is probably the finest single action revolver ever made. This specimen is heavily inlaid with gold and equipped with pearl and gold stocks. All experts agree on the perfection of this model as being the most accurate and graceful single action revolver ever made. It is now obsolete, but still unsurpassed.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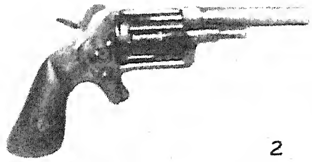
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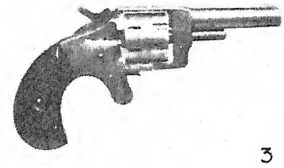
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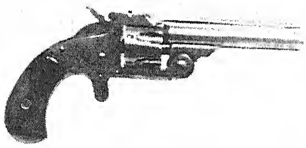
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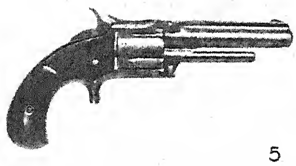
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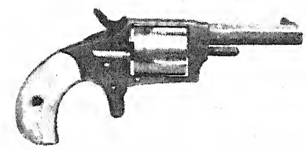
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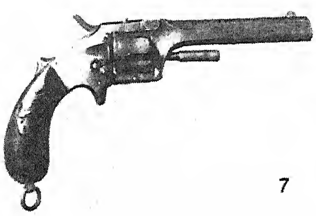
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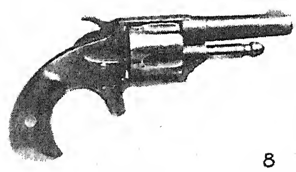
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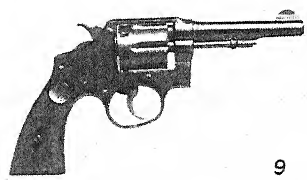
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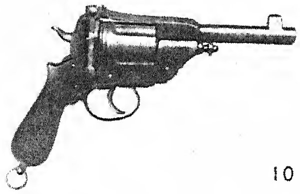
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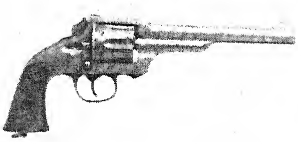
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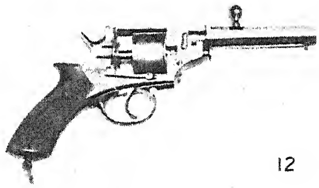
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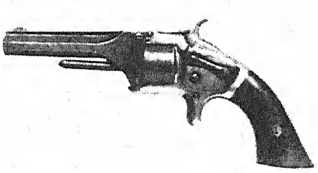
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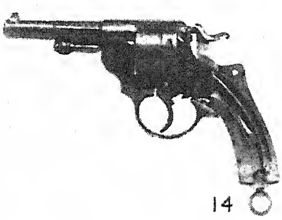
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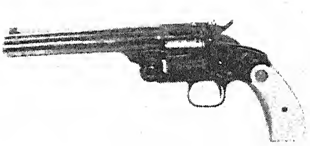
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the charge. The percussion model was on the same principle and also employed the box lock.

The Hall rifle of ·54 calibre was issued to U.S. troops in 1816 as an experimental arm. In 1827 several hundred were in use and orders were placed for two thousand more. It was used in the Seminole wars in Florida and in the Mexican campaigns, and was also used, although obsolescent, in the Civil War, 1861–1865. The works at Harper's Ferry have some historical importance as having been a centre of strategic value during the John Brown raid of 1859. Colonel John Hall was apparently a keen gun enthusiast, and his invention of 1811 was apparently made in ignorance of the large number of European predecessors in breech loading on the chamber principle.[1] It is not improbable that the Hall rifle was one of the great factors influencing Samuel Colt. The early Colt revolving rifles of 1836 have a hammerless action operated by a lever similar to that used to elevate the Hall chamber, and there are one or two other small suggestions which indicate the influence of Hall's ideas.

The United States armament was, however, mainly muzzle loading, and this issue of a few thousand Hall rifles did not lead to any general adoption of the system.

In Europe the Prussians developed a needle gun breech loader with the now almost universal bolt action. The novelty of the needle gun ignition system appears to have entirely overshadowed the importance of the bolt action breech. The weapon was the invention of Dreyse of Sommerda, who is believed to have taken most of his ideas from Paulet, a French gunmaker of ability, in whose workshops Dreyse was for a time employed. The needle gun introduced the use of a bolt action and also spiral springs and striker instead of the usual hammer and plunger.

Dreyse's patents were taken out in 1831, but his improvements were kept a close secret. Prussia adopted the arm in 1842, and it was used in the war of 1848, but attracted little general attention. In fact, the "Zund Nadel Gewehr" was rather discredited as a complicated and dangerous arm, and a piece of misapplied ingenuity, until the American War of 1861–1865, and the German-Austrian War of 1866, showed the decisive value of the increased rate of fire from any breech loader. Actually the Prussian needle gun was a poorly designed arm. The cartridge had no proper

[1] Letter to Colonel Bunford of U.S. Board of Ordnance, January, 1815.

base wad and no form of gas check or obturation pad. In the early models the cocking piece had to be pulled back by hand before the arm could be opened. In later models the self-cocking principle was incorporated, and the action developed into the early Mauser model bolt action. Apart from its loss of gas at the bolt head, the needle gun fired a peculiar ogival bullet which was ill-suited to the rifling and peculiarly inaccurate in flight. The needle which had to penetrate the whole length of the powder charge was often bent, corroded or injured, and the arm was easily put out of action. Despite these defects it was far superior in rapidity of fire to the muzzle loading rifles of the Austrians, and 1866 proved that in European warfare the speed of fire and battle advantages of the breech loader could beat all muzzle loading arms, however accurate.

The French did not take very readily to the breech loading principle. French inventors, such as Montalembert and Chaumette (1806), had put forward models. Bourdin, Lepage, Gastinne-Renette, Bruneel, and other gunmakers had advanced different systems, but none had proved worth serious trial. In 1830 a breech loading rampart gun or wall piece was issued. This arm had a pivoted chamber similar to the Hall system, but it was not effective and became choked with fouling after a dozen or two shots. The Robert rifle invented by Robert, a gunsmith of Paris, and greatly favoured by the Belgians, was invented in 1831 and was rather exhaustively tested by the French. In this arm a lever or tail projecting beyond the breech block serves as a cocking lever and lifting breech block combined. Subsequent models had a pivoted breech block rather similar to the Martini action and were locked by a toggle or elbow crank. The arm has an inverted hammer which lies below the breech block and hits a detonating tube incorporated with the cartridge. The "Fusil Robert" was not adopted by France, or other than to a limited extent by Belgium, but in 1854 the "Mousqueton des Cent Gardes" made its appearance. In this weapon a very similar type of cartridge was used with the ignition pin on the lower face of the cartridge. The action was an extremely odd self-closing falling block. This breech block was cocked by pulling it down against a strong curved spring bow which served as a trigger guard. The cartridge was then inserted, and when the trigger was pulled the breech block flew up, closing the breech and firing the charge at the same time. This device was not very satisfactory, but apparently the arm was designed

originally as a combined gun lance.[1] It is one of the first small calibre military arms, having a calibre of ·49 ins.

The Lefaucheux drop down principle, used in ordinary shotguns and sporting rifles, was not found suitable to military usage. Lefaucheux had, however, large factories near Paris and turned out a considerable quantity of sporting arms.

Another French arm of interest is the Demondion breech loader of 1831, which was very similar to the Robert arm, except that the breech block was hinged by trunnions to the end of the barrel. It, too, was a self-cocker and embodied a tube detonator as part of the cartridge. Some early double shotguns were made on this model.

In general the principle of incorporating the ignition system in the cartridge appears to have been better and earlier grasped in France than elsewhere, but the Cent Gardes weapon was soon condemned as impracticable and was followed in 1858 by the first kind of Chassepot carbine. This was not the later familiar bolt action arm, but had a lever operated lifting block enclosed in a box at the breech end of the barrel. This block incorporated an expanding gas check ring and the lock was an ordinary separate side lock not integral with the block. The cap was separate from the paper cartridge and placed on a nipple on the breech block in a way similar to the Sharp's rifle.

In 1866 the Commission of Vincennes experimented with the Chassepot and with the Manceau Viellard carbine, which was a bolt action arm of ·450 in. calibre with an obturator system of an expanding cone on the nose of the bolt head. A separate percussion nipple and lock were embodied. The Westley Richards carbine (see *infra*) and the Whitworth muzzle loader were also tested, as were the muzzle loading service arms of other nations.

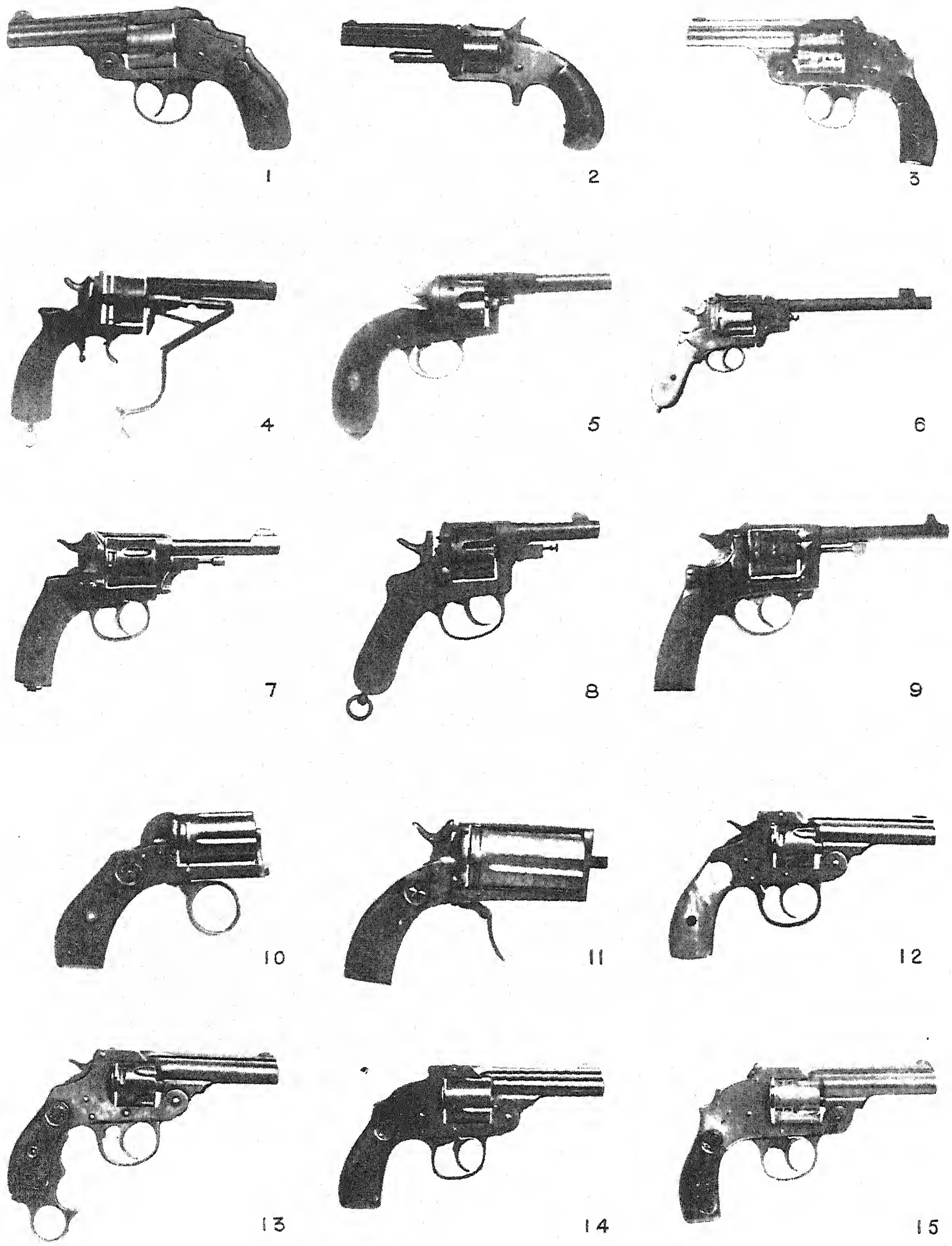
Experimental designs by Gastinne Renette were also submitted and the Favé rifle apparently reached a further stage than mere design. It was a bolt action arm using a metal based cartridge. The bolt head was on the modern interrupted screw thread principle, like the Ross or Mannlicher, and cartridge capping was employed.

The French Commission decided on general rearmament, and adopted a simple short block breech known as the "Tabatière" as a method of

[1] Botet, op. cit., Note E, p. 69.

BREECH LOADING REVOLVERS

1. Smith and Wesson ·38 pocket hammerless revolver. This weapon introduced the grip safety now used on modern automatics and is still a popular arm.
2. Marlin ·30 rim fire tip up revolver. Single action, dated 1872.
3. American Arms Co. ·38 hammerless revolver, *c.* 1890. This weapon resembles the Smith and Wesson, but has an ingenious provision for changing the double action to single action at will. A stud on the lock plate can be moved. The arm then requires one trigger pull to rotate the cylinder and cock it, a second independent pull on the same trigger accomplishes the discharge. This design was meant to provide the accuracy and light trigger pull of a single action arm in combination with the hammerless principle. An intercepting thumb operated safety projects above the grip.
4. Galand self-extracting ·450 calibre revolver. One of the earliest self-extractor devices. Model of 1870.
5. German ·450 single action solid frame ordnance revolver. These obsolete weapons were still carried by artillery and other troops in the Great War.
6. Montenegrin pattern revolver of unknown type and gigantic dimensions. The calibre is ·44, but the cartridge is bottle necked. The barrel tips up on the hinge levers forward of the cylinder which in turn is hinged to the top of the standing breech. The arm is of Belgian manufacture. (War Museum specimen.)
7. Austrian solid frame eight shot, ·32 calibre, high velocity gendarmerie revolver, modern.
8. Italian gendarmerie revolver, ·38 calibre, Gia. Tempini Brescia. This arm has a side gate for loading. The opening of this disconnects the hammer mechanism.
9. French service revolver, ·35 calibre, swing out side ejecting system. These revolvers are still the official weapon and fire a high velocity cartridge with a copper covered bullet. The velocity is high, but the stopping power inadequate.
10. German ·22 rim fire double action "pepper pot" revolver. It shows how the original simple pepper pot design has endured to the present century.
11. German ·410 four shot "pepper pot" for shot cartridges or "Deadless Pistol ammunition." The latter contained cayenne pepper, lycopodium spores aluminium powder and other ingredients meant to give flash and an asphyxiating gas. They were relatively innocuous. Date, 1910.
12. Iver Johnson ·32 pocket revolver. Typical American break down action. A moving limb attached to the trigger mechanism interposes between the hammer and the firing pin, reducing the danger of accidental discharge.
13. Iver Johnson ·32 police revolver, with peculiar knuckle duster grip. Date, 1902. The ring attachment allows the pistol to be swung on one finger, allowing the policeman both hands free to clap the manacles on his prisoner.
14. Harrington and Richardson ·38 hammerless revolver. A typical American pocket revolver of medium grade.
15. Reverse of No. 3, showing the peculiar down cast of the stock.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conversion of the existing large bore muzzle loading rifled muskets, but besides the conversion they adopted the improved model of Chassepot rifle. The decision was made in haste for the shadow of Prussia lay across the political outlook. Already Prussia had been at war with Austria; and Prussia was already provided with breech loaders.

By the autumn of 1866 the Chassepot had been authorised and the factories of St. Etienne, Mützig, Chatellerault and Tulle, supplemented by private contractors, were busy turning out the weapon. By 1870 all branches of the French army were equipped with the weapon.

It was a peculiarly bad selection, for the Chassepot was a poor weapon. In England we had adopted the Snider in 1866 and the Martini-Henry was on issue in 1869. Both these arms were superior to the Chassepot and used central fire cartridges. The French rifle used the bad system of needle fire ignition and a linen self-consuming cartridge. It represents perhaps the last stand of the paper cartridge, but with all its defects the Chassepot led the European world to a reduction of calibre from the traditional 20 bore (·577) to ·434 calibre and extended the practical range of military small arms from 1000 to 1800 yards. This weapon is authoritatively discussed in contemporary works.[1]

We must again turn back from this ominous date of 1870 to a consideration of the service arms used in the American Civil War of 1861–1865. For all practical purposes metallic cartridges were not widely introduced until 1863–1864. The campaign begins with a wide use of breech loaders using paper cartridges fired by an independent cap or tape primer. Many of these arms were later remodelled or converted to take true metallic cartridges. The Hall rifle of 1831 was in issue, and a few small experimental lots of Sharp's, Burnside and Spencer arms had been issued to cavalry units. With the outbreak of the Civil War no uniformity of armament was possible and all serviceable models were pressed into service. In most of these early arms a paper cartridge was used; some would, however, take either paper or metal cartridges which contained no cap, but were pierced with a hole to admit flash from an external primer. Others would only take this intermediate stage of metallic cartridge, but it will be convenient to group them as "paper cartridge" arms for the purposes of review, and to confine the metallic cartridge group (dealt with in a later chapter)

[1] *Le Fusil Chassepot*, par A. Giarard, 1872.

purely to those arms using a true cartridge containing its own means of ignition.

The Burnside carbine of 1856 had been issued before the war, and some 55,000 were made and used during the campaign. This arm had a movable chamber locked by an under lever into a recess below the barrel. It used a tapering brass cartridge case perforated to admit the flash of a percussion cap. It was of ·54 calibre.

The Maynard employed a very similar type of cartridge, but had a simple drop down hinged barrel operated by an under lever. The earliest models of 1841 used a paper cartridge with an indiarubber gas check base, but it was later modified to a metal case with a wide flange and a central flash-hole. Extensively used in the Civil War, calibre ·50.

Jenk's Navy carbine was issued in 1845 and had a top lever operating a short bolt or breech plug. The hammer of this weapon is similar to a walking stick gun hammer and has the peculiarity of cocking sideways. The nipple is recessed and placed laterally in the position of a flint lock touch-hole, calibre ·54.

The Sharp's rifle is perhaps the most important of all these actions. It was mechanically one of the soundest, and later made a very fine cartridge rifle. Over 18,000 were used during the war and many variations exist for paper, metal or metallic cartridges. Both caps and tape primers were also used. The Sharp principle employed a falling block operated by an under lever which served as a trigger guard. This block fell in a squared box breech exposing the chamber. The cartridge inserted, the closing of the lever pushed up the breech block, which had a sharp cutting edge which cut off the paper base of the cartridge, exposing the powder to the cap flash. It was simple, rapid and effective. The arm was well made and had a high reputation for range and accuracy. The gas escape with paper cartridges was, however, so marked that the arm was never adopted other than as an experimental issue in the British forces and was soon withdrawn as dangerous. The word Sharpshooter is a testimony to its reputation, calibre varied from ·45 to ·56.

Smith's carbine, 1856, employed a rubber cartridge fired by an external cap. The peculiarity of the arm was that the barrel was hinged and dropped so that the arm opened across the middle of the chamber. The cartridge was inserted in the mouth of the chamber with the bullet

projecting. On closing the gun this was received by the barrel end. The opening mechanism consisted of a spring catch flat along the top of the barrel engaging with lumps on the top of the standing breech. It was freed by pushing a stud lever inside the trigger guard in front of the trigger, calibre ·52.

Starr's carbine, 1858, was very similar to the Sharp in general construction and appearance. It did not have the guillotine cutting edge, but the hammer was self-cocking, calibre ·54.

Allen's carbine, 1855. This arm has a tap or faucet action breech opened by lifting a top lever which lay back along the comb of the stock. They are mostly of small calibre, ·38 to ·36, as this type of action was cumbersome with big bores. Made by Allen and Wheelock, of Worcester, Mass.

Perry carbine, 1855. An under lever operates a brass chamber bolt which cocks the hammer. On its closing movement, a recess in the bolt takes up a primer from a magazine tube in the stock. These arms are curious and rare, calibre ·54.

Joslyn carbine, 1855, Storrington, Conn. A hinged breech block is lifted by a top lever with a looped grip. Many subsequent modifications, calibre ·54, ·50.

Merill's carbine, 1858, Baltimore. A top lever operates a tap or faucet action, and a plunger loading bolt similar to the Jenk's carbine. The cylindrical breech bolt is faced with a copper gas obturator and the cartridge was made of nitrated material so as to be entirely self-consuming, calibre ·56.

Gallagher's carbine, 1860, Richardson and Overman, Philadelphia. A simple drop down action similar to the Lefaucheux gun, calibre ·54.

Terry's carbine, 1856, Terry and Calisher, Birmingham. A plunger or bolt secured in a breech extension is operated by a short folding lever; drawn back it exposes a side loading cavity into which the cartridge is dropped. On closing the bolt the plunger pushes the charge home into the chamber. The head of the bolt is fitted with coned piston head, meant to prevent the blow back of gas. This weapon was very good and many were sent to the Confederate States where it was known as the "Door bolt breech loader." It was experimentally issued to British cavalry in 1858 and could fire ten shots a minute and had a range of 1000 yards, calibre ·450.

Colt. See note on Colt arms.

Weaver, 1855, Windham, Conn. An under lever similar to a modern Winchester lever cocks the hammer, and permits the breech to be pivoted laterally. The action is rather similar to the Accles, Colt Derringer of later date.

Porter's rifle, 1851, New York. A wheel type revolver rifle. Cylinders hold nine rounds, calibre ·50.

Lawrence rifle, 1852. Greene rifle, 1856.
Rowe rifle, 1864. Greener, U.S.A., 1860.

These appear to be materially the same arm. The barrel pivots on an axis pin or rod below its breech and has locking lugs to secure it to the face of the standing breech. To load the barrel is rotated to the right or left, to free it from engagement and pulled forward along the guide or axis rod. Thus separated from the breech the chamber can be loaded. A taper ring on the projecting portion of the breech which fits into the base of the coned chamber serves as obturator.

This arm was experimentally tried by British troops, but was not satisfactory, calibre ·52, variations.

Prince, F., London, 1855. This weapon has a sliding barrel operated by a bolt lever passing through the stock and projecting before the trigger guard. A projecting plug on the breech is fitted with lugs and engages with slots in the breech of the barrel. The action is, in fact, an inversion of the usual bolt action in that the breech stays fast while the barrel is rotated and withdrawn. The device was supported by a wonderful testimonial from the London gun trade of the period. It was not a success, and it was not taken up by the Volunteers or authorities of the period.

Westley Richards, 1858, Birmingham. This action, in essence a simplification in detail of earlier ideas, both American and Continental, had the familiar plunger action lifted by a lever and hinged to the top of the barrel. A stout wad at the base of the cartridge was compressed against a brass plug on the end of the plunger, and the action was fairly gas tight. It was popular in South Africa and was good of its kind, calibre ·45. Many variations and later converted to take centre fire cartridges. Known as "Monkey tail."

Jones, 1846, U.S.A. A plunger operated arm with usual comb top lever. Retracted it exposes a small loading orifice on top of the barrel, calibre ·73.

Larsen, 1842, Drammen, Norway. The official breech loader adopted by Norway for service use. A pivoted chamber similar to the Hall principle. It is provided with an under hammer, and on closing the breech an eccentric action of the chamber pivot forces the chamber end against the breech of the barrel giving an attempt at a gastight joint.

Mont Storm, 1860, Belgium and Birmingham. A lifting chamber pivoted to the top of the barrel is secured by a bolt connected with the hammer. The charge is inserted in the chamber block. Action similar to the later Albini, calibre ·45.

Gilbert Smith, 1857, Connecticut. Barrel is hinged or pivoted to open sideways and locked by a flat spring on its upper surface, calibre ·52.

Vergigny, 1860, Paris. An under lever controls a rotating breech block which has a recessed nipple on one side and a loading opening on the other. Return of the lever through an angle of 90 degrees brings the chamber into axial alignment with the bore, calibre ·32. This action was later used on compressed gas rifles.

Needham, 1852, Birmingham. A rearwardly pivoted bolt is swung laterally out of the breech housing to admit a semi-needle gun cartridge. Double shotguns and some rifles were made on this principle, which is ingenious but not very practical. The striking mechanism is contained in the bolts and the cocking is automatic on opening the loading chamber.

Leech, 1861, London. The chamber block swings out similarly to the cylinder of a modern side ejecting revolver. It is kept in position by a spring catch. Probably J. Whitworth's patent, 1855.

Cooper and Goodman, 1860, Birmingham. Top lever toggle joint plunger system, similar to American models, calibre ·56.

Gibbs, 1861, W. F. Brooks, New York. Pressure on the trigger guard unlocks the barrel and moves it forward so that it can be disengaged from a projecting breech plug on the face of the standing breech. Barrel tilts to load. Similar to the French Pottet sporting gun.

Grainger, 1860, Birmingham. A simplification of the Needham bolt action, employing an independent ordinary lock and external cap ignition.

Greene, 1857, U.S.A. Simple bolt action. The nipple is on lower surface of barrel and a ring hammer in front of the trigger guard strikes upward. Probably a variation of the later model Greene with rotable barrel fastening to breech by lugs and sliding forward on an axis rod. It

used a rear bullet cartridge. The rear bullet acted as a gas check and then as a projectile for the next discharge.

Marceux, T., 1865, Paris. Lever operated top bolt or plunger. Rubber expanding gas check on nose of bolt. Ordinary percussion lock.

Merrell Latrobe, 1854, U.S.A. Lever operated top bolt or plunger. Access to chamber from below as in Burnside model.

Lindner, 1860, U.S.A. Pivoted chamber loading system, similar to Hall's patent. The joint of barrel and chamber is covered by a sliding cylindrical case.

Bethell Burton, 1859, U.S.A. Bolt action with interrupted screw locking. Drawing back the bolt cocks the lock, which is an ordinary side lock. On closing the bolt the action of the locking threads expands a piston head gas check on the bolt head. Many Burton variations exist as later metallic cartridge arms.

Treeby, T. W., Birmingham, 1855. This is perhaps one of the earliest models of a belt or chain-feed repeating arm. A series of chambers are made up as a long flat roller chain or belt. They have central fire nipples at the rear, while their mouths are coned to fit the barrel breech. The barrel has a bolt lever, and is fitted with a sleeve internally provided with an interrupted thread. Movement of the barrel forward cocks the arm and causes a ratchet wheel to move the next chamber into alignment. The return movement engages the barrel with the mouth of the chamber cone, which is somewhat elaborately shielded to prevent flash firing neighbouring chambers. A part turn of the barrel locks it by means of the intercepted thread on its sleeve to the frame or breech housing in which the chambers are housed. These remarkable weapons had chains of twenty or fifty chambers which were in some cases endless chains. Rare arm, variations, calibre ·50.

Lancaster, 1854–1857, London. Plunger type breech loaders using a peculiar paper cartridge with a bullet at the rear. This acted as a gas check for the first discharge and was in turn pushed forward to become the projectile of the next cartridge. Similar to Greene, U.S.A.

Altmann, Pieter, 1855, Dresden. An under lever raises a squared chamber breech block above the barrel for loading from the muzzle. It employed a needle gun cartridge, with spiral striker, which was retracted by the first movement of the lever before the chamber block rose, calibre ·40.

A general survey of the arms of this period shows that all the main mechanical principles of sliding block, lifting block, bolt action, swing out block, hinged barrel, etc., have been applied. Attempts to make repeating mechanisms are, so far as paper cartridge arms are concerned, limited to revolving arms, such as the Colt and Porter types. One or two specifications show a tube magazine beneath the barrel loading into a chamber block, but it is doubtful if any arms of this type were more than experimentally made. The paper cartridge was not suitable to mechanisms, for it needed hard ramming and was not sufficiently accurate in dimensions to work within any mechanical loading movement of a spring operated type.

The American Civil War demonstrated the superiority of the breech loader and above all the superiority of the metallic cartridge type of weapon. By 1865 the following quantities of breech loaders had been made and issued:

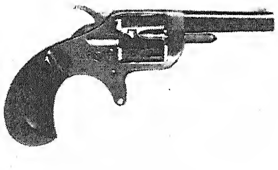
1002	Ball	11,261	Joslyn	30,062	Smith
1059	Ballard	892	Lindner	94,156	Spencer
55,567	Burnside	20,000	Maynard	25,603	Starr
22,782	Gallagher	14,495	Merill	9342	Union
1052	Gibbs	1000	Palmer	4001	Warner
3520	Hall	20,000	Remington	151	Wesson

The tendency was to substitute metallic for paper cartridges, and experience proved that the reduction of calibre did not affect the utility of the arms.

In 1864 the British authorities invited inventors and manufacturers to send in suggestions for the conversion of the Enfield muzzle loading rifle to a satisfactory breech loading system. In the main the systems submitted were those of existing arms adapted to the weapon in question. Bolt actions with paper cartridge. Westley Richards adaptions. Lifting blocks similar to the Berdan Montstorm and Braendlin-Albini models. Falling blocks like the Sharp or Starr. In the main a hinged lifting block was preferred by most competitors, and the existing lock and hammer were retained in many of the conversions. The arm selected was the Snider action of Mr. Jacob Snider which will be described in the following chapter.

COLT REVOLVERS

1. Colt single action ·22 seven shot rim fire pocket revolver, *c.* 1871.
2. Colt single action ·30 rim fire five shot pocket revolver. New Line Model, *c.* 1875.
3. Colt double action ·32 side ejector six shot pocket revolver, 1894.
4. Colt single action ·455 Bisley Model target revolver, *c.* 1885.
5. Colt single action ·380 central fire pocket revolver, *c.* 1885.
6. Colt double action ·22 rim fire seven shot Police Positive target revolver, 1910.
7. Colt double action ·410 central fire six shot Police revolver, *c.* 1880. Non-extractor model.
8. Colt double action ·380 central fire six shot Navy revolver side ejector, 1898.
9. Colt double action ·38 six shot rod extractor model, *c.* 1886.
10. Colt double action ·455 New Service six shot Army revolver. This arm has swing-out side extraction and was largely used in the Great War to supplement the regulation Webley-Scott revolver.
11. Colt House Pistol or "Clover Leaf" revolver ·410 rim fire, four chambered. Date, 1871.
12. Colt single action ·38 central fire, five shot pocket revolver, *c.* 1890. The usual curved butt is replaced by one of more substantial design.



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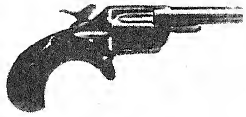

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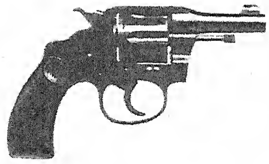

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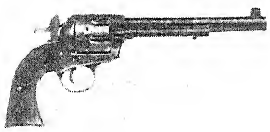

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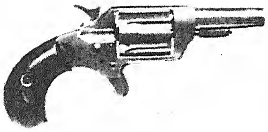

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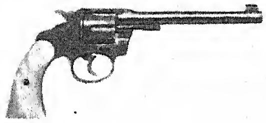

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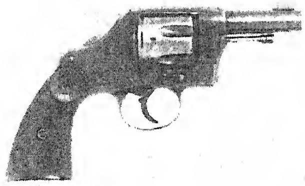

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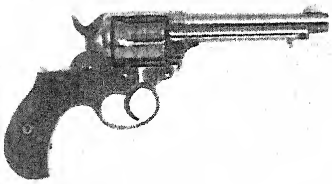

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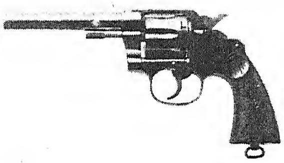

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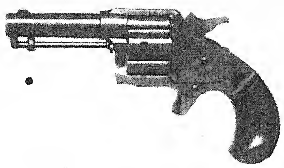

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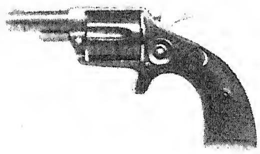

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Conversions of paper cartridge breech loaders to metallic cartridge types are not very common, except in arms such as the Sharp, which already had extended military use. In general, conversion meant the fitting of an extractor or ejector lever as well as replacing the nipple with a central fire or rim fire striker. In many cases they were inadaptable to any standard metallic cartridge and seldom were they worth the cost of conversion, except when it could be done in quantity.

CHAPTER VII

THE TRANSITION PERIOD

THE true metallic cartridge of the central fire system was approached by a transitional stage in which the cartridge consisted of a metal base and a paper case as we have it in the shotgun cartridge of to-day. Such cases were adopted for the French Tabatiére rifle, a conversion of their standard .79 rifled musket to a block breech action similar to the Snider. The cartridge used was practically a black powder 12 bore sporting gun cartridge. This was adequate with low pressures and large bores, but no paper case could stand up to the higher pressures of the small bore rifle firing a materially heavier charge of powder in relation to the weight of the projectile. Cases split at side and base. Caps blew out and a variety of minor troubles occurred. The most serious trouble was inaccuracy, and the shooting of the modified breech loaders was far worse than that of the old muzzle loaders before their conversion.

The reason for this lay in the bullet as well as in the cartridge. A short bullet was almost an essential with muzzle loading arms, and in most cases the actual bearing surface was reduced to the minimum in order to facilitate loading. Breech loading permitted the bullet to be lengthened and given a longer bearing area and a better distribution of weight. At first though the old muzzle loading bullet was retained.

The cartridge too was a poor thing as compared with the cartridge of to-day. In the original Snider it had an iron disc head as thick as a halfpenny, followed by a sort of tin thimble base to grip the paper. The paper casing itself was a poorly sized non-waterproof stuff, rather like brown paper, easily deformed and yielding to gas blast. The cap was small and deeply seated.

We may take the Snider action as typical of the 1866 period of conversions. The barrel of the regulation Enfield was fitted with a shoe, to which a breech block was hinged at its right hand side. The block was also

connected to an extractor hook sliding on a bed in the shoe, and was pierced diagonally with a spring plunger striker, whose head occupied the same position in relation to the existing ordinary side lock as had been occupied by the nipple. The block was secured by a spring catch, and when lifted to open could be swung upward and outward and pulled to the rear for a short distance along its bridge bar in order to effect extraction.

The original central fire case used in this arm was a modification of F. E. Schneider's patent of 1861, which had been developed by Daw for use in sporting guns. This patent could not be maintained in law and the principle of central fire was soon universally adopted by all kinds of cartridge makers, including Eley.

Colonel Boxer, of Woolwich, was appointed to modify the cartridge and improve the ballistics of the Snider Enfield. He made the bullet longer and with a deep base cavity, filled in part by a wood or baked clay plug. The fore part of the bullet too was hollowed in order to attain better balance. But the big change was made in the cartridge. Solid drawn large size cartridges were still unknown. Thin coiled brass was used instead of paper for the cartridge wall. The head of the case was still of iron, but was reinforced, and in this new combination of materials the cartridge was sound and gastight, while the shooting of the converted Snider now surpassed that of the muzzle loading rifle. In service the Snider was popular, and in a modified form it was used as a sporting rifle. It was issued in 1866.

The conversion of the Enfield to the Snider was purely a temporary measure, for there had been no reduction of calibre and the arm was admittedly regarded as a makeshift. In 1866 the Committee again invited proposals for a new form of rifle. Some hundred and twenty arms and fifty different kinds of ammunition were sent in by firms from all over the world. The report of the Committee a year later[1] was that nothing worth making a change for had been sent in.

This was not surprising, for in some of the arms the actions were good, while both ammunition and barrel were poor, ; in others this relation was inverted. They then decided to separate the question into decision on : A. A breech action ; B. Rifling and calibre. Inventors were asked to submit actions to take a definite barrel of given weight, length and calibre,

[1] December, 1867.

while in the meantime the Committee tested out the most accurate systems of rifling, as shown at Wimbledon in competition and at Woolwich and Enfield in official tests.

In 1869 they reported in favour of the Martini breech action, modified at Enfield, in combination with a ·450 calibre, 480 grain bullet of Henry's design fired in barrels rifled on the Henry system with wide shallow grooves. In 1870 modifications were introduced and the original long taper cartridge was reduced to the familiar bottle necked ·450–·577. This permitted the action to be shortened, and in April, 1871, the Martini-Henry was officially adopted.

The Martini is a simple falling block action in which one movement of the under lever opens the breech, cocks an enclosed spiral spring striker action and ejects the empty case. It was patented in 1868,[1] as an improvement on the existing Peabody patent of 1862, by F. von Martini, a Swiss.

The earlier Money Walker, 1868, used much the same movement and block, but in place of the trigger guard under lever it made use of a tail extension of the breech block lying along the block. In the Peabody an ordinary side lock and hammer were used and the block was pierced to take a long oblique striker plunger.

However doubtful as a new invention, it was a very good rifle and easily best in its own time. It gave great speed of fire and great accuracy, and was one of the best and most robust actions ever put into the hands of any army. In 1859 the results of the competition at Wimbledon show its value:

	Order of Merit.	Rounds in 3 mins.	Points.
Martini-Henry	1	55	127
Henry	2	47	118
Carter and Edwards . .	3	47	115
Soper-Henry	4	54	113
Westley Richards . . .	5	44	107
Bacon	6	39	79
Kerr	7	32	78
Broderick and Bissell . .	10	27	64
Soper-Henry side action model	11	27	59
Chassepot	14	30	50
Converted Chassepot . .	15	8	Broke down.

[1] Pat. No. 2305.

The competition had a three minute time limit. The ranges were 200 and 500 yards.

The Henry rifle, which nearly equals the Martini-Henry, had a falling block operated by a lever set before the trigger guard. The block was not pivoted, but had a direct rise and fall motion. In the earlier side action model the ordinary hammer was retained. Later this was abandoned and an internal hammer mechanism evolved.

The Carter-Edwards, 1865, was a self-cocking bolt action rifle having a simple lever hammer and flat springs in place of the familiar coil spring and striker of Continental design. Several variations.

The Soper, 1868, had a short breech block pivoted at the right hand of the breech as in the Snider. It was, however, quite short and was lifted and swung clear of its frame by the depression of a side lever which also cocked the hammer of the action. The arm was not unlike the Henry and was very rapidly operated.

The Westley Richards, 1866, was simply a modification of their paper cartridge breech loader in which the monkey tail block was still used, but a striker passing through the block was substituted for the nipple on the barrel.

The Bacon, 1867, had a rearward sliding breech operated by a pull up top lever. It had an internal hammer cocked by a supplementary trigger lever which allowed it to be retracted along a guide against the pressure of a spiral spring.

The Kerr, 1867, was a simple modification of the Enfield, employing an ordinary solid bolt of door bolt pattern, and retaining the side lock and hammer. A long firing pin passed through the bolt and a cartridge extractor, as used in the modern Mauser, was fitted to the bolt, which had, however, no separate bolt head.

The Brodrick-Bissell, 1865. So far as can be traced, this appears to have been a drop down action rifle, similar to a sporting gun, but self-cocking with an internal hammer operated by the fall of the barrel. A rotary under lever fitted round the trigger guard disengaged the locking lugs of the barrel from the frame.

The "converted Chassepot" was the Gras conversion, in which the rifle was altered with a new bolt head and extractor to take a central fire metallic cartridge case. It is still in use as a cheap single shotgun made from old army parts.

It is peculiar that in the above trial the celebrated Remington action is not mentioned. This was issued in 1863, originally as a rim fire carbine of ·56, and was one of Joseph Rider's patents. It is one of the simplest and strongest of known breech actions and was widely used all over the world. It is probably derived from the Geiger rifle action of 1862, which is almost identical. A short breech block is pivoted behind and below the breech. It is free to move only when the hammer is at full cock, for the body of the hammer or tumbler engages with curves on the rear of the breech block and locks it very solidly in position.

There are one or two peculiar models of Remington action with a split breech block admitting a thin and slender hammer.

This model is not mechanically as sound as the standard type. Remington rifles have been made in all calibres imaginable and were one of the cheapest and best known of all single shot actions.

The rifles favoured by the amateurs at Wimbledon at this time were not only representative of the arms considered by the Committee, but were the weapons then best for target shooting. The Committee had to judge the arms submitted to them not only from the points of accuracy and speed of fire, but also from their ability to stand up to service conditions.

Ten weapons alone had passed the preliminary tests; the bolt action arms of Wilson, Kerr, Carter Edwards and Bacon, and the block system weapons of Martini, Berdan, Henry, Money Walker and Westley Richards. The bolt actions did not function well and in two cases there were premature explosions. The Martini was also in danger of rejection, because it was a self-cocking arm, and it was thought dangerous to place such a weapon in the hands of a soldier.

The tests which eliminated the competing systems were strenuous. The arms were rusted by dipping in salt water and leaving them for two days. They were "sanded" in order to produce conditions akin to dust and desert warfare. They were fired with intentionally defective cartridges, with excessive charges and with cartridges permitting gas escape.

The rejection of the bolt system strikes us as peculiar to-day, but apparently the early bolt actions were ineffective and easily jammed. Even in Germany, where the Mauser action was to supersede the needle gun, authorities held that the Mauser bolt was really obsolete and that it would

be superseded by a block action.[1] Further, the American tests of 1872, at which the service arms of all nations were tried, resulted in a rejection of the Berdan, Chassepot and Mauser, Vetterli and Ward Burton bolt actions, Werndl, Werder, Remington block actions, Elliot, Freeman and Peabody arms, in favour of the Springfield. The failure of the Martini in the American trial was due to a breakdown after the rusting test.

The military rifle must now be left for a while, and the question of the sporting and semi-military rifles and carbines, many of which had been used as military arms in the American Civil War, considered.

Most of these were developments from the paper case to the metallic cartridge. In a few instances they are weapons designed from the first as metallic cartridge arms.

The Americans had a fondness for rim fire cartridges, and the rim fire was for a time certainly better than the early central fire cartridges as commercially supplied. Rim fire cartridges made the early repeating arms a practical proposition. These will be dealt with later under repeaters.

Among other American pieces we find:

Warners' carbine, 1864, Springfield, Mass. It has a block like the Snider, but in place of drawing back the bolt to extract the fired case a lever extractor beneath the barrel is moved by a projection passing through a slot in the fore end, calibre ·50 R.F.

Ballard, 1861, Fall River, Mass. An under lever depresses a breech block similar to the modern Stevens' rifle patents, calibre ·44 C.F., variations.

These arms were also popular in the bush-ranging days of Australia and were among the most accurate of American arms.

Palmer-Lamson, 1863, Lamson Arms, Windsor, Vt. Action similar to Terry, but uses an interrupted thread bolt. The side lock hammer hits a firing pin sited obliquely through the top of the barrel breeching. Probably a conversion of existing material, calibre ·56 R.F.

Starr. Converted to rim fire by addition of an extractor and replacement of nipple by firing pin.

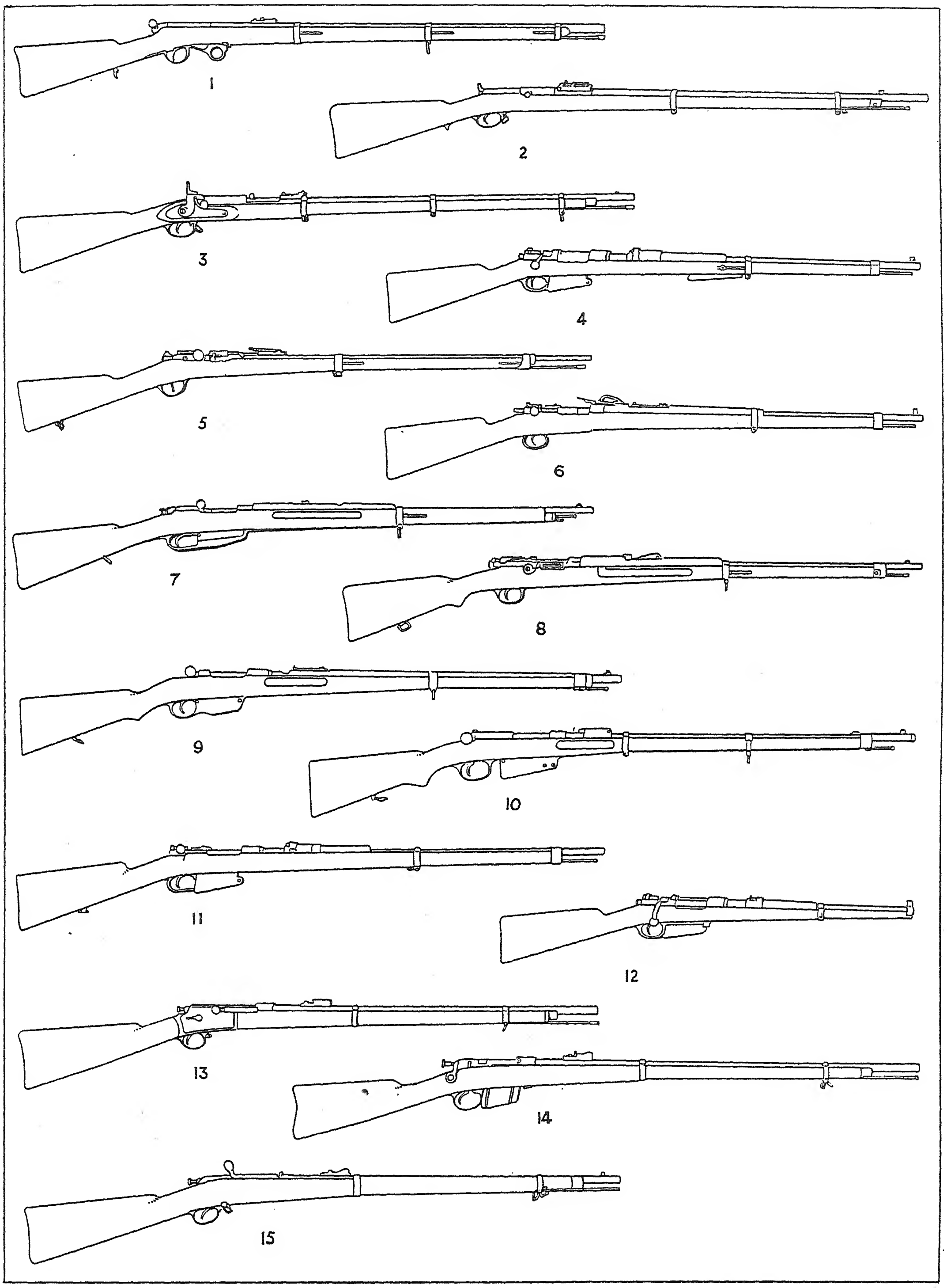
Joslyn. Similar to Tabatière, etc. Conversion, calibre ·56 R.F. Modified to Day rifle, 1864.

Sharp and Hawkins, 1859, Philadelphia. This is not the familiar Sharp

[1] Hentsch, Mauser Gewehr, Berlin, 1872.

MILITARY RIFLES

1. Greene. Bolt action, paper cartridge, breech loader, 1857. The bullet was at the rear of the cartridge and served first as a gas check for one shot, then as a projectile for the succeeding discharge. The hammer is a ring hammer forward of the trigger guard.
2. Berdan bolt action rifle, made for Russia in U.S.A. Lifting block action, 1870.
3. Berdan side lock rifle. A conversion from a muzzle loader, 1867.
4. Turkish pattern Mauser rifle. Model 1888.
5. Gras French service rifle. Model 1874.
6. Spanish Mauser. Model 1893.
7. Mannlicher, Roumanian model, 1893. Normal bolt action.
8. Mannlicher-Schönauer, Portuguese model, with revolving magazine.
9. Mannlicher, Austrian model, 1895. Straight pull bolt, clip loader.
10. Mannlicher, German model, 1890. Normal bolt, no cut off to magazine.
11. Mauser, Turkish model, 1890.
12. Mauser artillery carbine, Spanish type. Model 1893.
13. Winchester military magazine musket with bolt action. Model 1885.
14. Lee magazine rifle, 1890 model. This was modified to the Lee-Metford, and later to the Lee-Enfield British Service rifles.
15. Springfield U.S. rifle, 1872–1892. Later superseded by the Krag Jorgensen and by further models of Springfield magazine rifle. Models 1903 and 1917.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with falling block, but an under lever type with moving barrel. The barrel slides forward to load, calibre ·56 R.F.

Sharp's rifle, 1855, Sharp's Rifle Co., Hartford, Conn. These were remodelled to take rim fire, centre fire and other metallic ammunition. An extractor was fitted and a firing pin replaced the nipple. In addition to conversions later, well designed cartridge breech loaders were issued in calibres of ·50, ·45, ·44.

F. Wesson, 1859. Drop barrel action carbine with spring stud catch similar to modern Stevens' target pistol. In early models no extractor was fitted, but later a flat slide plate was attached to the side of the barrel. The arm was very accurate but frail.

Peabody, 1862, Providence Tool Co. Predecessor of Martini, but with side lock, calibre ·50 R.F. This arm later turns into the Peabody-Martini with which the Turks were armed during the Russo-Turkish War.

The U.S. official rifle, the Springfield, was converted to a lifting block system very similar to the Mont Storm and Braendlin-Albini types. The breech block hinged up over the barrel and ears on the bolt extension operated the extractor to clear out the case. The Springfield was later issued in various reductions of calibre down to ·45 and was for many years the regulation U.S. service rifle.

In Europe the Comblain falling block was adopted by the Belgians. The Werndl, an action very like the original Peabody, by the Austrians.

The Westley Richards breech loader of 1869 was a close competitor of the Martini-Henry. It had the same type of grooved falling block and a very similar action, and was operated by an under lever set before the trigger guard. It was perhaps the best of all actions for heavy single barrel sporting Express rifles and enjoyed a wide use and long life in South Africa, besides being adopted as a standard military weapon by the Boers.

The Berdan rifle, a top block action similar to the Springfield, was adopted by the Russians. These rifles were largely made by Colts' at Hartford, Connecticut, while the Turks were armed with the Peabody-Martini made at Providence, U.S.A.

In the main sporting rifles followed military models. The Field rifle, London, 1870, was little more than a modification of the Henry system and the Swinburn, London, 1869, was simply a Martini with a flat mainspring in place of the coil type. Of the two the Field had more use as it allowed

the barrel to be cleaned from the breech end. This is of importance for match rifles, and the action in various forms was used by many gunsmiths for sporting arms. In essence it is simply the substitution of a vertical sliding or falling block for the pivoted type used in the Peabody-Martini systems. In the U.S. a similar arm was known as the Remington Hepburn.

There was a wide separation between the European and American systems once the metallic cartridge was established. There are occasional hybrids, such as the Charrion, an under lever bolt action of American type, but French parentage, and the Albini-Tersen of Belgium, which is simply a modified Springfield. The Ward-Burton rifle, made at Springfield, is, on the other hand, a typical European bolt action rifle of ·50 calibre, yet is of American invention and manufacture.

There are a number of systems which never bore fruit and never passed far out of the experimental stage. Restell's rifles of various patterns, Wylie-Webleys, Benson and Poppenburg's, Howard's rifle (later modified to a shot gun and sold as "The Thunderbolt"), Peabody-Enfield conversions, Mathews, Stevens, Benjamins, Valasse and many others present features of interest and add to the range of a collection, but they are not of material importance.

Some of the conversions are ingenious, notably that of the Smith carbine, in which the indiarubber cartridge was seated half-way between barrel and breech. This would seem to baffle all ideas of conversion, but the difficulty was overcome by the Crispin cartridge, which had a raised rim or belt around its middle and tapered away to each end. This was used in the Smith, the firing pin hitting the fulminate belt. In general only military arms were converted, for it was not an economic process unless a quantity could be so amended. The change in calibre from the large muzzle loading bores of ·75, ·60 and ·56 to the almost universal ·45, or ·43 of the metallic cartridge single loading service rifle made all the large bores obsolete except for special purposes. The Snider was a favourite big game rifle for close jungle use, for its big bullet hit a smashing blow. The same value of a large ball made the converted Sharp rifle the chosen arm of the buffalo hunters of the 'seventies in the U.S.A. These men also used the heavy Dragoon Colt ·44 muzzle loading revolver for close work, as the charge was powerful enough to kill even these heavy animals.

Metallic cartridges were early used in pistols and revolvers. The first

were European pin fire arms, such as those made by Lefaucheux and shown at the Exhibition of 1851. These had been in limited use for some years previously.

The first American metal cartridge pistol to attract notice was the Sharp's four barrelled "Protector" of 1859, made by Sharp's Arms Co., Philadelphia, U.S.A., and also by Tipping and Lawden of Birmingham. This was made in ·22, ·300 and ·380 calibres and had four barrels bored in one solid block. This block moved forward along a slide to permit loading. There was no extractor. The hammer mechanism was single action and had a ratchet operated nose which moved round through 90 degrees in order to fire the successive barrels.

The Marston pistol, New York, is earlier in date, 1857, but was not apparently made till 1864. It was known as the "Up and Down" pistol, as the single barrel lay on top of the pair. The barrels were hinged and the striker could be varied from barrel to barrel at will, calibre ·38.

The Bacon pistol, 1864, was simply a six barrelled pepper-box using the ·22 R.F. loaded at the breech.

The Rupertus pistol, 1864, Rupertus Arms Co., Philadelphia, was a rather better arm than the Bacon, with eight fluted barrels of ·22 calibre.

F. Wesson, 1866, turned out under-and-over double-barrelled pistols of all calibres. These had to be turned by hand round a central spindle to bring the second barrel to alignment. Similar arms were made by Woodward in London in 1863.

Moore's pistols, 1861, are the all metal so-called "Derringers," later made by Colt as "No. 1" or National Derringers.

The original Moore's were of ·32 and ·38 calibre rim fire and were made by Moore Firearm Co., Brooklyn, N.Y. The Colt-Moore's were always of ·410 calibre rim fire.

Williamson's pistols, 1866, New York, resemble the real wood stocked percussion Derringer, but have an internal barrel screwing into their barrels. This liner takes a special metal cartridge pierced to admit the cap flash.

Hammond's pistols, 1866, Connecticut Arms Co., is of the Derringer type. The breech swings to one side to load, calibre ·410 rim fire and ·44 Colt rim fire.

Remington pistol, 1886. This was a regulation cavalry arm for the

U.S. forces and used as ·50 central fire cartridge; standard Remington breech. Pistols of this type, in all sorts of calibres, were also manufactured in Belgium and Spain for export to South America. Double-barrelled specimens are common.

Remington Derringers were made under Rider's patents, 1861–1864. These arms had a curious square handle and a split breech block into which a very thin hammer fell, calibre ·22 and ·410 R.F. Another Remington Derringer had a standard Remington action and took the ·410 R.F.

In addition there was the repeating Remington Derringer of ·32. This frail, but beautiful little pistol, held five small cartridges in a tube beneath the barrel. A breech slide depressed by the thumb and drawn rearward ejected the empty case, cocked the hammer and elevated a fresh cartridge. Release of the thumb lever carried the new charge into the chamber. Many of these pistols were beautifully mounted with pearl or ivory handles and were plated and engraved. The cartridge is, however, very ineffective and the arm lacks hitting power.

The Remington Elliot pistol of 1862 was a curious four barrelled arm of ·30 calibre. It had a ring trigger with a very long stiff double action pull operating an internal revolving hammer. The barrel block was hinged and opened by a sliding bolt which pulls out from in front of the trigger. It had no extractor. The Remington Rider revolver was somewhat similar, but a sliding trigger stud moving in slots on the barrel block was used to rotate the chambers in place of the familiar ratchet mechanism.

All these models were superseded by the Remington under-and-over double-barrel Derringer of ·41 calibre, with barrels hinged to swing upward from the frame. This was issued in 1868 and is still made. An automatic moving nose on the hammer fires each barrel in turn.

The Ballard Derringer, 1864, had a hinged barrel and a ratchet extractor operated by the opening motion. The calibre was ·41, but the arm had a bad reputation for blowing open at the breech.

These small single or multiple shot pistols were erroneously called Derringers and owed their vogue to the prevailing use of firearms in the settlement of personal disagreements. These affairs were not formal duels, such as the European meetings, but casual homicides achieved on the spot, often over gambling affairs. These little pistols occupied extremely little space yet carried a ball of relatively large size. They could be

concealed in the hand or fired through the pocket, but were only useful at very short range.

The peculiar conditions of the U.S. patent laws were responsible for the production of some extremely quaint revolvers, loaded by unusual means, or using odd ammunition specially invented to avoid the particular difficulty. The same ideas do not appear to have been applied to the carbine or rifle, but purely restricted to the revolving pistols. Among the most interesting of these transitional devices are :

Plant's revolver, 1863, Plant Manufacturing Co., Conn. This was a simple solid frame arm using a peculiar rimless yet rim fire cartridge. The cartridge is recessed or dished at the base and the fuminate is contained in the rim between the indentation and the wall. A peculiar little ejection lever or pusher device is fitted along the side plate of the lock and the expended shell is ejected forward from behind.

The National Arms Co., 1865, employed cartridges of the same type, but a small pivoted hook lever which projected the empty case a short distance was used instead of the extractor or push rod of the Plant.

The Eagle Arms Co., 1863, manufactured revolvers on the same principle with a small bolt ejection rod. Their arms were mostly pocket arms of ·30 and ·32 calibre, and later used ordinary rim fire cartridge.

The Crispin, 1863, Smith Arms Co., used the same belted cartridge as was used in the converted carbine previously mentioned. The cylinder is divided into two sections to admit the loading of the cartridges.

The Moore revolver, 1863, used a cartridge with a conical end terminating in a fulminate filled tube or tit. This projected through a hole in the base of the chamber and was hit against the central ring of the axis sheath by the hammer. No ejection system appears to have been practical, but a hooked pusher was provided.

The Brooklyn Arms Co., 1863, used ordinary rim fire cartridges, but contained in each chamber a sliding sheath which had to be slid forward so that the cartridge could be dropped into the recess. The sheath was then pulled back, admitting the cartridge with the exception of its rim. These queer and frail arms are rare in Europe. The French Polain pin fire revolver was similar in principle, but resembled the Galand in that all the chambers were accessible by one forward movement of the chamber and barrel along its axis pin.

The Pond revolver, 1863, L. W. Pond, Worcester, Mass. This was similar to the Brooklyn, but the sheaths were loaded not through the side of the cylinder as in the former, but were withdrawn to a peg beneath and at the side of the barrel. The cartridge was then dropped into the cylinder and the sheath slid back, enclosing the cartridge and so forming a double safeguard of sheath and cylinder.

In addition to these oddities, the collector and student will find many cases where a conversion of an existing muzzle loading revolver has been made, by either fitting a new cylinder and altering the standing breech or recoil shield of the frame to admit a cartridge, or by fitting a ring containing strikers in place of the nipple section of a muzzle loading cylinder.

Many of the alterations were ingenious, few successful. In most cases the existing loading lever could not be modified into an extractor and entirely new mechanism had to be fitted. The majority of these alterations were carried out by private gunmakers rather than by the big firms, but certain Colt, Remington and other revolvers exist in a transition stage, and it is plain to see that stocks of material designed for muzzle loading pieces has been adapted to the new breech loading models. Such arms are usually recognisable by the retention of the loading recess and by the unusually long cylinder, the new cylinder incorporating the space previously occupied by the nipples, while another indication is the absence of a top strap connecting barrel to the top of the standing breech in those patterns such as the muzzle loading Colt. The true breech loading Colts genuinely designed as such and not made out of old material have a solid frame.

Smith and Wesson are generally held to be the firm who first definitely made revolvers for the metallic cartridge, and it is generally accepted that their revolver is antecedent to all conversions.

They began to manufacture breech loading metallic cartridge rim fire revolvers in 1855–1856, but also made the repeating pistols later known as the Volcanic Arms Co.'s products. They held a patent of Rollin Whites' for boring cylinders clear through to the rear to admit of breech loading,[1] and a magazine was also fitted to the butt to supply further cartridges to the cylinder.

The early S. & W. revolvers were solid frame arms of small calibre, ·22 and ·30, and were not always of their own make, but manufactured for

[1] 1855, U.S. pat.

them by other firms, such as the Lowell Arms Co., Mass. The output was probably small and variable.

The solid frame of 1861 was replaced from 1863 to 1865 by a tip-up system, in which the barrel was hinged to the standing breech and held by a catch in front of the trigger guard. This system was copied in other American revolvers and by the early breech loading Webleys in Britain. A cylinder stop in the top strap operated by a raised nose on the hammer was patented in 1859. A fixed rod beneath the barrel served as a peg on which to force out the empty cases.

After 1863 the firm began to put out a large range of very beautifully made tip-up pattern single action revolvers in ·22, ·32 and ·38 rim fire. The change to the familiar breakdown self-ejecting model did not take place till 1871 when the first ·44 calibre central fire revolvers were issued. In 1875 the design was extended to a complete range of breakdown self-extractors in ·32, ·38, ·44 and ·45 calibre. In 1877 the double action model was issued. In 1883 the hammerless ·38 and ·32 pocket models appeared.

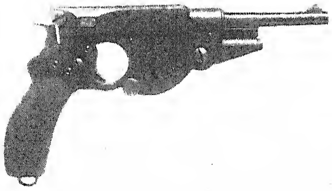
The ·44 Smith and Wesson "Russian" model is probably the finest single action revolver that has ever been made, or ever will be made. It is no longer made because modern cartridges were too much for the breech fastening. This objection does not amount to much, for the arm could be made the Webley stirrup top grip (whose patent has expired) and stand any charge. Smith and Wesson design has, however, since 1904, gone over to the solid frame swing-out cylinder type initiated by the early French service revolvers. The mechanism is still refined, but the solid-frame arms lack that perfect grip and balance which distinguished the weapons of their best period. From the point of view of target shots, the arm is too light to fire heavy charges with comfort, and the grip does not satisfy in practice.

The Colt breech loading revolver did not appear until 1871 when a crude four chambered "House Defence" model with a gun metal frame was issued. This weapon took the ·41 rim fire cartridge used in the metal Moore type and "National" Derringer pistols made by Colts. It was a bad arm, and is now known as the "Clover Leaf Colt" and is very rarely found. A variation with a $\frac{3}{4}$ in. barrel, known as the "Bull Dog Colt," was also made.

At the same time a number of remodelled Navy revolvers of ·38 calibre,

AUTOMATIC PISTOLS

1. Bergman automatic pistol, ·30 calibre, clip loader, original model, " blow back " or inertia system, 1896 model.
2. Bergman target model with set or hair trigger and adjustable target sights, 1897 model of 7·65 calibre.
3. Simplex automatic pistol, ·33 calibre. This is one of the first pocket automatics, and it follows Bergman design. A box magazine is substituted for the clip loading device. The pistol was unsuccessful largely because of the ammunition which was not crimped, but had the bullet loosely seated.
4. The military model, Bayard, 1910. This arm was officially adopted in the Spanish army and other forces. It still shows the Bergman design, but has a locked breech action and a moving barrel system.
5. Sauer pistol, ·32 calibre. In this arm the barrel is locked to the breech and recoils with it to the full extent of the recoil stroke, as in some machine guns. No appreciable increase of projectile energy or velocity is gained by this complex mechanism.
6. Luger or Parabellum pistol, 9 mm., model, 1915. This was evolved from the original Borchardt pistol of 1895, and retains the toggle joint locked breech mechanism of the original design. It was the German Army official Service automatic pistol, and was issued in shorter barrel length than that illustrated. The long barrelled type was fitted with a wooden stock and occasionally with a spring operated helical thirty-two shot magazine.
7. Savage ·380 automatic pistol. This employs a delaying action rather than a true locked breech. The barrel is free to rotate through a small angle. The bullet moving against the twist of the rifling is said to temporarily lock the action so that the recoil slide is not freed from the barrel till the projectile is out of the barrel.
8. Mauser ·32 automatic hammerless pocket pistol. This pistol of ordinary blow back type has the recoil spring in a recess beneath the barrel.
9. Astra 9 mm. automatic Spanish Service pistol. This is a blow back arm for a powerful cartridge and has the spring round the barrel. The angular butt at the wrong angle to the barrel is bad design.
10. Webley ·25 automatic pistol fitted with silencer. Fiction writers are fond of " silenced " pistols. In practice they are cumbrous and not particularly silent. The sharp crack of the cartridge is only damped and even the little ·25 still makes a substantial report.
11. Star ·32 automatic Spanish. Blow back type with external hammers.
12. Colt ·45 U.S. Government model. This arm has a locked breech action and is probably the best military automatic yet designed. The barrel moves on a hinged link or " parallel ruler " action and slide and barrel are locked together for the first part of the recoil movement. During the war this weapon was made in ·455 calibre for the Canadian troops.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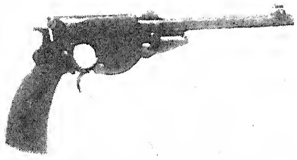
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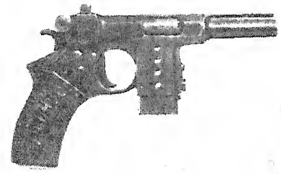
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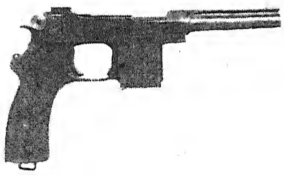
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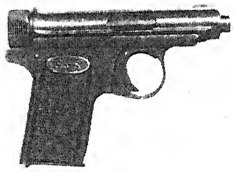
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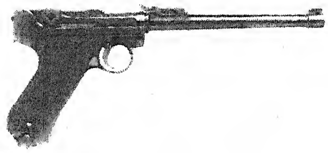
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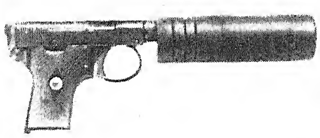
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made from old ·36 muzzle loading parts very little modified, were issued. Some of these arms had the side ejector rod, but not the solid frame of the later familiar army or frontier models. The latter was officially adopted by the U.S. Army in 1876, after trials proving its superiority over the Remington, Smith and Wesson, and Merwin and Hulbert revolvers. Double action was not adopted by Colts' until 1884, and the self-extractor models date from 1892.

The evolution of revolvers proceeds first to the solid frame metal cartridge revolver. In the U.S.A. most of these were single action and had an open trigger unprotected by a trigger guard or bow. In Europe the preference was always for a double action arm with a guarded trigger. The revolver of 1870 to 1890 shows the gradual supersession of the non-extractor in favour of breakdown, or other self-extracting action, and the development of a safe and secure catch top fastening.

In the Smith and Wesson a rack and pinion mechanism operated the central extractor in the earlier models. This later gave place to a modified cam action. It may be taken as typical of the breakdown type.

The Galand and Somerville, 1878, London and Paris, was one of the earliest European self-extractors. Pressure on a lever beneath the trigger guard freed a hinged toggle or elbow bolt beneath the barrel, so that the whole barrel and cylinder could be moved forward along the axis pin. A separate plate at the rear of the cylinder held the cartridges and moved part of the way with the cylinder. Its motion was then arrested while the cylinder moved on. This plate withdrew the empty cases, so that they could be shaken free of the action. The pistol was, however, a loose and shaky construction and was never popular.

The Thomas, 1880, Birmingham, was an improvement, for a rotating bolt action on the barrel was substituted for the breakdown hinge joint. The extraction was performed by a cartridge plate in the same way as in the Galand.

The Tranter, 1869, Birmingham, was a breakdown action similar to the Smith and Wesson, but the barrel was secured by a thumb lever instead of a pull-up catch. This lever ended in a hook which passed over a bolt on the side of the top strap and so secured it to the standing breech. It provided the basis for the later Webley self-extraction models.

The Enfield, 1876, was the first official British revolver and was the

worst arm of its kind ever made. It had a hinged barrel which did not drop, but pulled the cylinder forward along its axis pin as in the Galand. The cartridges were not ejected, but had to be shaken clear. It was designed by O. Jones, an American, and was a signal failure.

The Webley was to England what the Colt was to the U.S.A. The firm began with muzzle loading revolvers in 1853, and about 1865 was making a tip-up pattern revolver which was a copy of the Smith and Wesson of the period. It used the same cylinder stop, the same rim fire cartridges and had one peculiarity, ratchet rifling.

In 1868 they brought out their solid frame central fire ·450 calibre R.I.C. revolver, which was adopted by Colonial governments as a sound police arm. In 1881 the Webley hammer had a safety notch in the nose similar to the Smith and Wesson Russian model.[1] This was closely followed by the celebrated pocket models, the " British Bull Dog " and the solid frame non-extracting " Metropolitan Police " models of 1883. The range of calibres was wide and they made a big solid frame " Army Express " for the official regulation ·476–·455 cartridge. This was a powerful long cartridge with a bullet with a clay plug in its base similar to the old Snider box cartridge. By 1884 Webley's had issued several varieties of ·455 calibre breakdown revolver with different forms of central ejector and top grips. In most of these pivoted levers on the side of the action withdrew a locking bolt passing from the side through the lugs of the standing breech into a recess in the top strap. In the " Model 5 " there was only one of these levers. In the " Chinese Navy " model there were two, one on each side. There are many small variations in the shape of the wooden butt, and in the cylinder dismounting mechanism. In 1885 the stirrup top fastening was patented.

In 1889 the first W.G. Target revolver appeared. This arm had the true stirrup safety catch which distinguishes the Webley top fastening, and it had the solid steel strapped butt with two wooden grips in place of a chequered solid wood block handle. The extraction and cylinder removal system were the same as in the Mark I and the Chinese Navy models. The W.G. was a target arm of remarkable precision, and in the same year was issued the Mark III, which was a reduced model of ·38 calibre with a differently shaped butt and a shorter barrel.

[1] Pat. 5143, 1881.

The Mark IV, which was the standard army revolver of ·455 calibre, was issued in 1893. This and officers' models varied in shape of butt and barrel length, but were the same in principle. There were variants of dimension and the parts were not truly interchangeable. The standard officers' model revolver of this period was the "parrot beaked" W.G. army revolver, but expert shots always preferred the long 7½ in. barrelled W.G. with the target or W.G. handle. This, now no longer made, was the finest double action target revolver that has been made to date. It had the smoothest trigger action in the world and can be fired by an expert at a higher rate of speed than any automatic pistol of equal calibre.

Although Colt, Webley and Smith and Wesson are the great firms, and the only firms still making first-class revolvers to-day, there were then many smaller makers.

The Remington Arms Company made one or two good, but rather frail, revolvers on Beal's patents. They were never widely popular.

Hopkins and Allen of Norwich, Connecticut, made the Merwin and Hulbert revolver, 1877–1883. These interesting pistols have a rotating barrel which on turning disengages from the standing breech and frame and can be pulled forward along the axis pin. The rims of the cartridges are held by a ring on the face of the standing breech, and thus drawn clear of the cylinder. To reload, the arm had to be closed and cartridges inserted through a side gate one at a time. These arms were made in ·44–·40 and ·38 calibre and are excellent specimens of workmanship, but the design was not suited to military usage and was inferior to the contemporary Smith and Wesson.

Hopkins and Allen have also made large quantities of modern, both solid frame and breakdown revolvers of medium grade and small calibre.

Prescott, 1860, Worcester, Mass. Solid frame calibre ·36 rim fire revolvers.

Joslyn, 1861, Joslyn Arms Co., Stormington, Conn. Seven shot rim fire calibre ·38 revolvers known as "Seven shooters."

Shattuck Arms Co., 1873, Hatfield, Mass. The cylinder axis is pivoted at the muzzle end of the barrel, and the whole cylinder system can be swung out at right angles to the frame for ejection and reloading.

Reilly, 1882, London. Breakdown action revolvers of ·450 calibre.

Daw, G. H., 1875, London. Early central fire solid frame revolvers modified from percussion.

Bland, London, 1883. Imported a cheap Belgian breakdown action resembling the early Webleys.

Crane, 1885, Royal Exchange, London. Graceful little single action pocket revolvers with engraved gun-metal or bronze frames.

Lancaster, Chas., 1882. Two and four barrelled pistols with internal revolving hammer and oval rifling, calibres ·455, ·38, ·320, also double ·577.

Braendlin Armoury Co., 1878, Birmingham. A somewhat similar four barrelled pistol, calibres ·450, ·380.

Cone, 1860, Washington, D.C. Early rim fire solid frame revolvers. Lower's patent.

Moore, Daniel, 1862, Brooklyn. Seven shot single action revolvers of ·38 calibre. The barrel and cylinder pivot on the lower extension of the frame so that both can be rotated to the right, like a "swing out" type of revolver, for reloading.

Marlin revolver, 1872, Standard Arms Co. Tip-up revolvers similar to the Smith and Wesson early model, but with different cylinder stop device.

Smith, 1873, New York. Single action rim fire solid frame revolvers with a spring axis pin similar to the modern swing-out type of Smith and Wesson lock. The cylinder is not, however, swing-out, but removable by hand. This patent is the basis of the modern Smith and Wesson swing out and later devices.

The European continental revolvers show little of interest, and inferior copies of British models represent the major portion of their pocket arms.

The Le Mat revolver with the central barrel was modified to a breech loader, and was for a while a service issue in the French Navy.

The Nagant, made by Pieper of Liège and adopted by Russia, presents a form worthy of notice. It is a return to the early principle of endeavouring to eliminate gas escape between chamber and barrel by moving the cylinder forward. The metallic cartridge is, however, used in the Nagant not only as a breech gas check, but as a joint gas check at the barrel chamber joint. The cartridges are long brass sleeves completely enclosing charge and bullet and project over the front of the bullet. The chambers are coned at their muzzle to admit the coned breech of the barrel, and the cartridges are so long that they project out of the chamber

proper into the chamber cone. When the arm is cocked the chamber is moved forward by a wedge member and the projecting cartridge mouth is forced into the rear end of the barrel making a gastight joint. This ingenious mechanism gives no practical advantage over the ordinary revolver, as with careful workmanship the gas losses are very low, and the complexity introduced by endeavouring to check them is a far more serious disadvantage.

The original single action pin fire Lefaucheux of ·450 (12 mm.) calibre was adopted by France for naval use in 1853. In 1870 the pin fire cartridge was abandoned for a central fire one, but the type of revolver remained unchanged except for the incorporation of a double action. During the war of 1870–1871 various arms were pressed into service, Colts, Le Mats, Kerrs and British and Belgian reproductions of American types were all used.

In 1873 the crude Lefaucheux shape was abandoned and a simple solid frame double action revolver of 11 mm. calibre adopted. In the following year a refined edition of this arm appeared as the standard officer's model revolver.

In 1886 the French Government adopted a swing-out cylinder self-extractor revolver of extremely small calibre, 8mm. ·38 in. which fired a hard lead-coated bullet propelled by a charge of concentrated nitro powder. In 1892 a copper-coated bullet was used in place of the hard lead. This revolver and the Swiss regulation revolver, which is very similar, represent the first use of metal patched or coated projectiles in pistols. The model was stabilised and modified in detail and issued for general service as the *model d'Ordonnance*, 1892.

The first recorded European revolver for central fire cartridges appears to be that patented by Perrin and Delmas in 1859. This was similar to the old Lefaucheux and had no top strap joining barrel and breech.

The hinged barrel drop action appears as a patent by M. Lavelle in 1861,[1] but there is no ejection system and simply a removable cylinder somewhat reminiscent of the Star revolver of the U.S.A., but breech loading. Rather later in the same year the Adams' breakdown revolver appeared. In this the central axis pin on which the cylinder revolved also served as a breech lock. The arm occurs solely as a patent specification, so

[1] Pat. 1362, 1861.

far as can be traced, and I have not been able to find any specimen in metal. There is little doubt though that this hinged breakdown principle, combined with the self-extraction principle, was entirely European in origin, and evolved from the progress being made in drop down barrel shotgun actions. Its later adoption by Smith and Wesson was an extremely justifiable reprisal for the piracy of their tip-up model by British makers.

In general the design of revolvers shows no main changes to 1890, if we except the unsuccessful attempt of Mauser in 1878 to substitute rotation of the cylinder by a stud moving in external diagonal grooving on the cylinder for the conventional ratchet action. This system was used again in the present century in the Webley Fosberry automatic revolver.

It is not easy to fix any definite limit to the transitional period, but it will be convenient to consider it as covering the period from 1865 to 1890. That is to say, the change from the single shot muzzle loader to the single shot black powder breech loader military rifle marks the beginning of the era, the change to small bore smokeless powder magazine rifles, the end. In the same period we find the rim fire cartridges superseded (with the solitary exception of miniature arms of ·22 calibre) by the central fire system. Pin fire arms vanish except for the cheapest types of trashy revolvers of Belgian make, and little by little the black powder weapon, whether rifle, shotgun or pistol, becomes obsolescent.

The process of evolution is accompanied by a curious diminution of the sources of supply. Little by little old names drop out or are absorbed into more dominant concerns. Particular models, such as the Remington or Martini actions, remain in the present century sole commercial survivors of the great body of curious inventions proffered a bare twenty-five years before. Calibre decreases, range increases, and the modern metal jacketed bullet and high pressure smokeless charge modifies all design.

Before we can proceed we must retrace our path and consider the development of repeating and magazine rifles.

CHAPTER VIII

REPEATING AND MAGAZINE ARMS AND EXPRESS RIFLES

A REVIEW of all the different progressive steps in military small arms shows that the one thing which in the end appeals to the military mind is a *quicker rate of fire.* Extremes of range, flatness of trajectory, refinements of precision are of little importance compared to the one virtue of an increased fire delivery. Yet this in itself is not enough. The arm must not only be quicker to load and fire than its predecessors, but must also be available as a half pike or spear and strong enough to stand the rigours of service use.

We have seen the slow struggle of the rifle against the smooth bore and its poor measure of success, until the breech loading principle made it a far speedier arm to use than the old musket. We have treated of the revolving principle rifles as a chamber breech loader rather than as a repeating mechanism. This may seem an inversion of that particular principle, but in practice the revolver rifle or carbine was not used as a revolver repeater or multi-shot arm by troops to whom it was issued. With big charges the flash from one chamber escaped at the barrel joint and often cut its ways past the bullets in the other chambers, so that simultaneous explosion occurred. The famous Colt muzzle loading revolving rifles have nothing to commend them. All that can be said was that Colonel Samuel Colt was a master of publicity at a time when this art was little understood. His wretched compatriots to whom the arms were issued had their left hands blown away, until it became the accepted practice to use the Colt revolving rifle as a single loader. If the repeating function was to be used the unfortunate sharpshooters were accustomed to pull down the loading lever and hold this instead of the barrel! The lever thus used brought the position of the left hand below the line of fire of the muzzles of the other chambers, but even used thus, both the precision and the

morale of the shooter had to suffer. After the Civil War, Colt rifles were sold out of the service for forty-two cents apiece!

There have been other attempts to use the revolving system. The Cochrane and Porter carbines with radial cylinders were unsuccessful early types. The Needham, an English invention of 1858, used a modified type of needle gun cartridge fed from a tubular magazine beneath the barrel into a cylinder with three chambers. These in turn loaded, fired and served for forward ejection of the spent case. The arm was operated by an under lever.

Certain Belgian makers have issued modified revolver carbines for very light charges, and revolvers have been fitted with extension stocks and long barrels, but the principle is never a successful one, even with metallic cartridges. It may now be said to have been finally discarded for all weapons except single hand revolving pistols.

The repeating or magazine principle could not be applied effectively with either loose powder or ball or paper cartridges with external ignition systems. It depended on the invention of the metallic cartridge. The early repeaters were termed repeating or magazine arms indifferently. To-day most people understand the term repeater as covering lever operated arms with the cartridges carried in tubes either in the butt or beneath the barrel. The term magazine rifle now designates a bolt action rifle with a box magazine attached to the action. There are, however, types which may be called by either name.

The first effective and widely used magazine repeater was undoubtedly the Spencer carbine, patented in the U.S.A. in 1860 and widely used during the Civil War, both in rifle and carbine form. Christopher Spencer was only nineteen when he invented the arm. He proceeded to Washington when the Civil War broke out, but had difficulty in getting a hearing. Eventually he had an interview with President Lincoln at the White House. Lincoln personally tried the weapon and is reported to have instantly given orders for it. In all, over 94,000 of these arms were made.

The Spencer rifle had a tube magazine in the butt. This was loaded through a hole in the heel plate and closed by a tubular sheath containing a spring plunger, being pressed home so as to envelop the cartridges. A trigger guard lever operated a falling block which, revolving backward on its axis, admitted a cartridge from the magazine. The closing of the

lever raised the cartridge on the face of the block, which served as a cartridge carrier, and further motion pressed it home into the chamber. The arm had to be separately cocked. The rate of fire was sixteen shots a minute, the magazine capacity nine rounds. The cartridge was a large bore rim fire of ·56 calibre. The arm was popular, but suffered from several defects, of which the most serious was the tendency to explosion in the magazine. This was probably due to the jar of recoil driving one heavy rim fire case back against another, and it was later generally admitted that large bore rim fire cartridges were dangerous in tube magazine arms. The calibre was later reduced to ·50 and the magazine capacity to seven shots.

The Spencer does not appear to have been the first American tube magazine breech loading repeater, although it was the first to be widely used. There was a previous arm made by L. Jennings about 1854[1] which had a tube magazine beneath the barrel and a ring trigger operated rising and falling block action. The cartridges for this arm were originally metallic with external ignition, but were later rim fire. These arms were made by Robbins and Lawrence, Windsor, Vermont, but Jennings himself, or possibly an earlier C. Jennings, made crude flint lock repeating arms of the type in which several charges are superimposed on one another and the lock is shiftable along a rack from one touch-hole to another. Another arm which is probably of Jennings' design takes small conical projectiles whose bases are recessed to take a heavy charge of fulminate but no powder. European models of this latter type and French manufacture are not rare.

The Jennings was followed by the " Volcanic," made by Frank Wesson in 1854. This was made both in rifle and pistol form and was substantially the forerunner of the Henry and the Winchester. It had an under lever operated bolt action which fed cartridges from a tube beneath the barrel to the chamber and cocked a rear hammer. The magazine loaded from the muzzle end. In the pistol the under lever took the shape of an additional ring trigger, and as the lever had a very long travel, greater than the stretch of the opened fingers, the grip on the pistol was released and the arm thrown upward in the hand with a jerk. The arm contained no

[1] The Jennings patent is probably that of 1855, No. 2313, registered under the name of Newton, a communication.

firing pin, but a piercer on the bolt head which served as an extractor. The whole bolt was free to move a slight distance forward, but it is not at all clear what kind of cartridge was used in the arm. I am inclined to think that it must have been not a rim fire, but something similar to the Lancaster case with a sandwich of fulminate between the base and an internal wad, and that the piercer served as a firing pin as well as an extractor.[1] Wesson sold the patents and the works to the Volcanic Repeating Arms Co., Newhaven, Conn., and the arm was improved by Tyler F. Henry, who in 1860 brought out the Henry rifle. This arm is substantially the Volcanic modified to take a suitable large bore rim fire cartridge. In 1866 it was merged in the Winchester, which in early models differs from it in little, except that the Winchester magazine loads through a slot in the action and does not have the same method of loading the magazine from the muzzle end, as is found on the Volcanic and Henry arms. The Henry calibre of ·44 was long the standard favourite for repeaters, but the early arms were for rim fire ammunition and had gun-metal breech receivers.

The first central fire repeater appears to have been Ball's carbine. This had an under lever action and a tube magazine below the barrel. The hammer served as an additional security to maintain the breech block in a locked position. The arm was made by the Lamson Arms Co., Windsor, Vermont, in 1863, and sparingly used during the Civil War.

Scott and Triplett's repeating carbine was issued in 1864 by the Meriden Arms Co., Conn. This arm resembles the Moore and National Derringers, or the Rowe and Lawrence carbines of the period, for the barrel moves round on a horizontal axis pin and ejects the cartridge at the side. A full half rotation brings it opposite the tube magazine which passes through the stock and a cartridge is passed into the chamber. The arm took rim fire cartridges of the Spencer model.

In 1871 the Evans carbine appeared. It was the invention of Warren Evans, of Mechanic Falls, and was a modified Spencer of ·44 rim fire calibre with a stock containing a remarkable archimedean screw magazine holding thirty-two cartridges.[2]

The repeater system did not become established until the success of the 1873 model Winchester proved that it was suitable for cartridges

[1] Perhaps some American expert may be able to clear the point for me.
[2] Pat. No. 2261, 1873.

of what were then looked on as substantial power. The 1873 used central fire cartridges with flat nosed lead bullets and eliminated the old trouble of magazine explosions from the impact of rim fire cartridges.

The British patent specifications from 1863 to 1873 show little European interest in the repeating system. In 1871 a curious Jarre pistol appears in which a frame of sliding chambers or a multi-chambered flat block is passed across the barrel axis from right to left. A few pistols of this kind were made in small calibres, both rim fire and pin fire, but it is not a true repeater, but rather a multi-chambered arm. In 1872 a Burgess patent occurs for a rifle with an under barrel tube magazine. The system later became the Colt repeating rifle.

The first bolt action military repeater seems to be the Edge rifle of 1874–1875,[1] which adds an under barrel tube magazine to the formal single loading bolt action. It is closely followed by the Hotchkiss, a similar arm with a butt tube magazine,[2] and by the Remington bolt action with a sub-barrel tube magazine.

These early military rifles represent a bridge between the successful sporting repeaters, such as the Winchester and Spencer arms which fired a relatively small low velocity charge, and the heavy military rifle with a powerful charge and a long weighty bullet of ·45 calibre. The lock work of the repeaters was intricate and had many small parts, and they were not solid enough to answer the traditional demand for a service firearm which could be primarily rather than secondarily used as a spear.

We see the inventive mind dallying with the compromise of a Winchester type magazine and a military bolt action, and it is worth while remembering that at this date most of the military cartridges were twice the size of the present types and that in many cases the cartridges were not the familiar drawn brass "solid case" of the present era, but the twisted brass foil and paper type of the regulation Martini-Henry. The size of the cartridge imposed arbitrary limits on inventors and the tube magazine, which in butt or below the barrel was the only solution which prevented a monstrous clumsiness.

The standard single shot military rifle was a fairly clumsy piece of work. The bolt action Mauser which followed the needle gun, the Gras which

[1] Pat. No. 3643. [2] Pat. No. 4320, 1875.

followed the Chassepot, the Italian bolt action Carcano, the Austrian bolt action single shot forerunner of the Mannlicher, all these were big weighty weapons.

The transformation to repeating mechanisms precluded the use of the now almost universal box magazine, as with the big cartridges only four or five could be held in such a box, while the butt magazine tube would hold six. Clip or container loading had not yet been thought of.

The Hotchkiss was made by the Winchester Arms Co. for the ·45/70 cartridge used in the Springfield, and this cartridge was far shorter and less efficient than the Martini cartridge of 450/577 with 85 grains of powder and a longer and heavier bullet. The American military repeaters were, therefore, unsuitable to European use—unless Europe were prepared to adopt less efficient ammunition than conventional standard. The Hotchkiss, the later Chaffee-Reece and other representative American types could only hold five of the short 45/70 cartridges in their butt magazines. The European cartridge would have reduced this reserve to four. As a result we find that the European preference went to the barrel tube magazine which, though objectionable as altering the balance of the arm as cartridges were used from the reserve, yet held more rounds.

The first European magazine military arm was the Swiss Vetterli rifle of 1869–1871. This arm held ten bottle-necked rim fire cartridges of ·400 calibre and was converted in 1874 for central fire cartridges. A self-cocking bolt action operated a bell crank lever to raise a cage or carrier which received cartridges from a tubular receiver below the barrel. The weapon was heavy and uncouth but fairly reliable.

In 1881 a tube magazine was added to the Mauser modification of the old Dreyse needle gun and a calibre of ·433 adopted.

This was followed by the Gras-Kropatschek rifle issued for the French marine, 1886–1887. This was a barrel tubular magazine adapted to the Gras modified Chassepot action. In the same year the French Lebel was issued in ·433 calibre. It was the first bolt action rifle to have a loose non-rotating bolt head.

All these were tubular magazine systems, and no others appear to have been tried except butt magazines and their curious variations, in which multiple tubes, archimedean screws or vertical hoppers were introduced into the butt to supplement the reserve of cartridges in the tube. Arms

of this nature were the Schulhof, the Osterreich Waffenfabrik issue of early Mannlichers with multiple revolving stock tube magazine, the Larsen and similar freaks.

These were unnecessary, for in 1879 Lee had patented his box magazine, and we see the idea applied in various forms to subsequent arms not only the Lee, the Lee-Winchester and Lee-Burton, but to the Kropatschek of 1884, and nowadays the box magazine is used in one modification or another on every military magazine rifle with the solitary exception of the obsolescent Lebel, which still retains the tube.

The Lee magazine in its early stage only held five cartridges, but later it embodied the principle of holding them staggered and it would take any length, provided that the travel of the bolt was enough to admit a full length cartridge.

The change from single loader to magazine was accompanied by many conversions or adaptations of existing arms. In the case of any bolt action arm where the bolt could be drawn back so far as to admit a full length cartridge it presented little difficulty, but falling block actions were impossible to change. Numerous inventors tried to alter the Martini action, either to receive charges from an attached side box magazine shaped as a segment or from tubular magazines below the barrel. Some even approached the problem by attempting to feed cartridges from a butt tube through the falling block.

O. Jones, the designer of the bad Enfield revolver, produced a repeating Martini with no trigger,[1] in which a sliding trombone action hand grip on the small of the butt was pushed up and down to reload *and fire* the arm! In 1884 and 1885 Paulson patented semi-automatic recoil and gas pressure operated Martini actions.[2] These may, however, be taken as purely experimental arms, having no influence on the evolution of the military rifle.

The years 1886 to 1890 usher in an entirely new phase, that of the sudden conversion to small calibres and smokeless powder, a proceeding which entirely changed the existing systems and did away with many of the restrictions which had limited invention applied to existing design.

Taking the year 1880 as representative of this period of transition, we

[1] Pat. No. 4942, 1883. [2] Pat. No. 14,015, 1884.

find nearly all the great Powers armed with large calibre block powder single loading rifles, exceeding ·4 in. calibre, and magazine arms being tried experimentally.

Austria used the Werndl ·433, but was also experimenting with the Fruwirth, an arm similar to the Vetterli bolt action repeater.

Belgium used the Braendlin-Albini ·433.

Denmark, the Remington ·433.

England, the Martini-Henry ·450.

France, the Gras of 1874–1878, the Kropatschek, all ·433, and the early model Lebel.

Germany, the Mauser, 1871, and the 1871 converted to 1884 model ·433 repeater.

Greece, the Gras ·433.

Holland, the bolt action Beaumont ·433.

Italy, the Vetterli ·409.

Norway, the Remington ·433.

Portugal, the Remington ·433.

Roumania, the Peabody-Martini ·45.

Russia, the Berdan model II ·45.

Serbia, the Mauser Milanovic ·40.

Sweden, the Remington and Jarman ·433.

Spain, the Remington ·433.

Turkey, the Peabody-Martini ·45.

U.S.A., the Springfield ·45.

The early military big bore repeaters or magazine rifles adopted were first the Kropatschek issued in 1878 to the French marines (not the army). Second, the Jarman repeater used by Norway–Sweden in 1881. Thirdly, the Mauser of 1884, known as the Mauser-Commission, a conversion of the 1871 single shot Mauser was adopted for the German army in 1884. This was the first instance of a general military adoption of a magazine arm by a large power. This was followed by the Mannlicher of 1886, which was adopted by Austria. The Vetterli-Vitali of 1887 was adopted by Italy. This was a modification of the old Vetterli of 1867 which had been improved and adopted by the Swiss army in 1881 (the Vetterli-Vitali had a box in place of a tube magazine), and in 1888 Holland adopted the

Beaumont-Vitali, an adaptation of the box magazine to the Beaumont rifle.

None of the foregoing need discussion, with the exception of the 1886 Austrian Mannlicher, which introduces several new principles. Although it retained the big bore of ·433 it was a box magazine arm and the first clip loader. Five cartridges in a steel clip were used to charge the magazine. When empty the clip fell through to the ground through a slot in the base of the magazine. The bolt action was not on the usual lift and pull system, but was a straight pull, that is to say it operated on a straight pull and push principle. A quick spiral on a sleeve inside the bolt engaging the intercepting lugs on the head of the bolt with the extension of the breech cover at the end of the barrel.

The genesis of the modern small bore military rifle is due to experiments, with a view to flattening the trajectory of projectiles, which led to the invention of the metal patched or coated bullet and to the discovery of a practical smokeless powder suitable for use in small arms.

With a low muzzle velocity and a fat short bullet, a slow twist of the rifling was adequate. The old Snider of ·577 bore had a twist of one turn in 78 ins.

The reduction in calibre to ·450 initiated with the Martini introduced a long bullet which required a more rapid twist in order to keep it spinning during flight, and the twist was increased to one complete turn in 22 ins. The ballistic principle involved may be ignored, but the principle can be easily grasped if we consider the bullet as a top. A squat top will spin steadily on its axis at a very slow rate before toppling over. A tall thin top will topple over far sooner when the revolutions decrease below a certain number per minute. Experiments showed that a reduction of calibre was desirable in the interests of increasing muzzle velocity, but it was found that in order to insure steadiness of the projectile the twist had to be speeded up to one turn in 10 or 12 ins. The lead bullets would not stand this. They " stripped " in the rifling, cut to pieces and followed inaccurate paths.

In 1883 Major Rubin, a Swiss, brought out the first bullet in which the rear part was sheathed in a copper capsule which was hard enough to take the rifling without stripping, while the forepart and core consisted of soft

SPANISH MAKERS MARKS

Marcas y Contramarcas de los Arcabuceros de Madrid, que no han sido de Rey, pero sus Obras de merito y estimacion

*Alonso Martinez	AL^o MAR TI NEZ.
*Manuel Sutil	MN.^L SV TIL.
*Diego Esquibel	DI-ES QUI DEL.
Luis Santos	L SAN TOS.
Juan Santos	JVA SAN TOS.
Josef Lopez	JOSE LO PEZ.
Benito San Martin	B^O S. MAR TIN
Ygnacio Barcina	INAZ. BARZ INA
Pedro Fernandez	P^O FER NAN DEZ.
Pedro Ramirez	PEDR^O RAMI REZ.

Arcabuceros actuales en Madrid.

Pedro Fernandez	P FER NAND EZ
Carlos Rodriguez	CARL RODRI GUE Z
Antonio Navarro	ANTO NIO NABA RRO
Carlos Montargis	CARLOS MONTAR GIS
Juan Lopez	IVAN LO PEZ
Valentin Lopez	VA LENT LO PEZ
Manuel Cantero	M MANU EL CANTE RO
Basilio Escalante	BASILIO ESCA LANTE
Manuel Soler	M MANO EL SOLER
Hilario Matheo	HILA RIO MA THEO

Isidro Soler lo delineó. — lo grabó.

Marcas y Contramarcas de los Arcabuceros de Madrid, que ha habido de Rey desde el año 1684 hasta el presente de 1795

Juan Belen	IV BE LEN
Nicolas Bis	NCL.^S BIS.
Juan Fernandez	IV FER NAN DEZ
Matias Baeza	MAS BA EZA.
Josef Cano	IOSE PH CAÑO
Francisco Bis	CO FRN. BIS.
Joaq.^n de Zelaya	IHN DZE LAYA
Gabriel Algora	G EL ALGO RA
Sebastian Santos	SEV SAN TOS
Diego Ventura	DIEO VEN TVRA
Fran.^{co} Lopez, reserv.^o	FRC LO PEZ
Antonio Gomez	ANT GO MEZ
Agustin Ortiz	AGUS HOR TIS
Miguel Zegarra	J M G MIGE ZEGA RRA.
Salvador Zenarro	M SALVA DOR CENA RRO
Fran.^{co} Ant.^o Garcia	FRAN ANT.^O GARZ.^A

Arcabuceros actuales de su Magestad.

Diego Alvarez	DIEG.^O ALBA REZ
Juan de Soto	JUAN DE SOTO
Ysidro Soler	M. ISIDRO SOLER
Franc.^o Targarona	FRCO TARGA RONA
Gregorio Lopez	GRE LO PEZ

Isidro Soler lo delineó. — lo grabó.

lead giving the necessary weight to the projectile. Experiments with small bores using these compound bullets continued for some years, and in 1887, following on pressure stimulated by public discussion, the Small Arms Committee was directed to investigate the claims for the small calibre high velocity metal jacketed bullet.

They had the Lebel rifle of ·315 which had been adopted by the French in 1886 to accelerate their deliberations. The Lebel was adopted by the French, however, not so much in response to careful experiment as by political action. A French chemist, M. Vielle, had produced what was claimed to be a practicable smokeless powder; the French tested it and perceived the enormous value of such an invention in warfare. To-day we have forgotten the old tactics of black powder. Ranging was easy, evolutions were executed under cover of smoke, and the direct and indirect effect of powder smoke entered into all the calculation of warfare. There was no concealment possible. The use of smoke was rediscovered in the last years of the Great War, and General Sir Hugh Tudor, who was perhaps the first to appreciate the rediscovery and the use of smoke screens to hide troops, soon held the record for progressive action with the minimum of casualties. In the next war we shall use smoke screens and visible tracer bullets, leaving a smoke trail midway between target and point of origin.

Smokeless powder as an individual advantage to one combatant might well decide a campaign. So thought General Boulanger, the French political Dictator of the period. The new smokeless powder, and *révanche* for Alsace and Lorraine! He ordered a rifle to be made for it within two months, and the Lebel was the result. It was the first official smokeless powder small bore and embodied the familiar bolt action and tube magazine below the barrel. It was not used against Germany till 1914, for Boulanger lost his nerve and ran away to Brussels, where he committed suicide rather than face the absolute issue of war with Germany, which his political action would have rendered inevitable.

Nevertheless, the introduction of the Lebel by France rendered the rearmament of the European powers inevitable.

The year 1888 marked the beginning of the general change. Germany adopted the Mannlicher ·311 bore and introduced for the first time the principle of multiple or clip loading now universal.

In the same year Great Britain adopted the rifle known as the Lee-Metford. This was a composite arm embodying the Lee bolt action (greatly improved by experiment) and the Lee box magazine fitted to a Metford barrel.

The new rifle superseded an improved variety of the Martini-Henry in which the bore had been modified to ·402 in. This improved single loader had been evolved not for smokeless powder, but for a compressed form of black powder, which was thought to give some advantage in velocity over the ordinary grained black powder.

This compressed black powder was the first ammunition used in the Lee-Metford of 1888, or Mark I pattern. The French powder was not deemed suitable as it tended to deteriorate and explode in magazines, and was not suitable for British Imperial requirements where ammunition has to stand both tropic heat and intense cold within the geographical limits of the empire. It was thus not until 1892 that the new propellant, cordite, a mixture of nitro-cellulose gelatinised with nitro-glycerin, was issued as the standard British service ·303 cartridge.

Europe as a whole adopted the small calibre and smokeless powder rifle slowly, the period of rearmament, beginning with 1888, lasting until 1903, when the last of the small powers, Roumania, adopted the ·256 Mannlicher. Japan and the U.S.A. followed the European standards.

Before passing to the further discussion of the new small bore military magazine rifle we must consider the large number of black powder sporting rifles, both single, double and magazine. In general the heavy calibre big game sporting rifle, if a single loader, was a modification of some existing military or match rifle system. We find Snider, Martini, Soper, Field, Westley Richards, and other falling and sliding block actions fitted to short sporting barrels and suitable butts and half-stocks. These actions are just the same as the standard military or match ones, but show a higher degree of refinement and a removal of all crude excess weight. The sights undergo many changes, and in general the sporting rifle was seldom equipped with sights for over 500 yards. Where long range tangent sights are found it is usually because the arm was for the South African market.

The gunmakers had their own particular fancies in rifling, and the very shallow Metford grooving, which permitted easy cleaning, was the greatest favourite. The Whitworth barrel is found on the early types,

but later Rigby, Henry, and Gibbs of Bristol, all developed modified rifling systems of their own which were exceptionally good for sporting use.

The heavy rifles were known as "Expresses" and fired a relatively large powder charge, giving what was then held to be an extremely high velocity to the bullet. The great desideratum in these arms was, then as now, a flat trajectory, for game is shot at unknown ranges and it is essential that the path of the bullet should be as flat as possible, so that an error of range judgment does not necessarily involve a miss above or below an animal.

The Express cartridges were, therefore, more powerful as regards the ratio of powder to bullet weight than the military cartridge, but they lacked the extreme range of the latter. They were made in both taper and bottle-necked forms and in some cases special cartridges were evolved by private makers, such as Gibbs, and Rigby.

The general sizes in use for black powder sporting Express rifles were:

·577 3 in. case taper.
·577 2¾ in. case taper.
·500 magnum bottle-necked 3⅛ in.
·500 straight taper 3¼ in.
·500 straight taper 3 in.
·500 bottle-necked 2 13/16 ins. "No. 2 Express."
·450 magnum bottle-necked 3¼ ins.
·450 straight taper 3¼ ins.
.450 straight taper 3 ins.
·450 bottle-necked 2¼ "No. 1 Express."
·450 No. 1 Westley Richards carbine 1½ in. bottle necked.
·450 No. 2 Westley Richards musket 2 5/16 ins. bottle necked.
·450 regulation 450/577 Martini.
·400 magnum bottle-necked 3¼ ins.
·400 bottle-necked 2⅜ ins.
·400 straight taper 2¼ ins. "Boss Express."
·360 straight taper 2 7/16 ins.
·360 straight taper 2¼ ins.
Some of these are still obtainable.

We find the same sizes of cartridge used in the black powder double-barrelled Express rifles of the period. These are usually magnificent pieces of gunsmith's work, but they are now obsolete and relatively valueless, for they cannot be usefully converted to any purpose. The lever beneath the trigger guard was usually preferred to the more modern top lever, but side lever actions operated by the thumb were also popular.

Continental sporting single and double rifles were usually made for less powerful charges than the British Express types. In general they were not used against dangerous game abroad, but more for deer and wild boar in Europe. They seldom pass the ·400 calibre, and fired a long taper cartridge of relatively high velocity but low striking power. They have an indifferent reputation.

When we consider the early American black powder repeaters we are at once struck by the low power of their cartridges as compared with the British big game weapons. There is an essential difference. The American hunter has no dangerous game to meet, with the extremely occasional exception of grizzly bear.

The early 1873 repeaters made by Winchester, and later by Marlin, Colt, Spencer and other companies, were restricted to a range of ·44/40, ·38/40, ·32/20 and ·22. All of these are cartridges used in revolvers and carbines, and the ·44 with 40 grains of powder was only efficient on medium game up to about two hundred yards. As self-defence weapons or as small game rifles these were adequate, but they were not suited to heavier needs. The buffalo hunters relied on the ·50 Sharp's single shot with 90 grains of powder, whereas the smallest of the ·500 English Express rifles took 130 grains of powder.

In 1886 the Winchester Company brought out a new range of repeaters, with a more solidly locked under lever bolt action and a cartridge carrier which would take a large cartridge. Their most powerful arm took a ·50/110 Winchester cartridge taking 110 grains of powder. The magazine took eight cartridges, but owing to the weight of the arm it was usually made in half magazine, that is to say, with the tube cut short to hold four rounds.

The Winchester 50/110 may be taken as the most powerful of the black powder repeaters. But it was never popular in India or South Africa. The smaller sizes of 45/90 and 45/70, this latter the U.S.A. military

cartridge, enjoyed a moderate distribution but were little used except in the U.S.A.

In general the little 44/40 Winchester was the most popular and enjoyed a world-wide sale. It was a convenient weapon for light all round use, and is still made, but for improved smokeless powder cartridges of increased efficiency.

In general, American black powder repeating rifles, whether Winchester, Marlin or Colt, appear to have found their maximum utility in the 44/40 calibre, using cartridges interchangeable with the Colt Frontier revolver.

The ·360 Express was the smallest black powder calibre used for medium game or deer stalking; below it came the American repeaters of ·44/40 and ·38/40, and then we come to a wide range of small rifles usually classed as rook or rabbit rifles.

In general these are single shot hammer or hammerless arms modelled on sporting gun lines, but somewhat more mechanised. The hinged barrel system is almost universal, and, beginning with breech loading needle gun cartridge rifles, called "pea rifles," in which a long pivoted striker or nose to the hammer penetrated the charge, they progress through all varieties of pin, rim and centre fire. The opening lever is customarily a side thumb lever acting on a hook bolt engaging with a lug on the lower surface of the barrel, but there are many variations. Bolt actions are few, but Martini and falling block actions are common. Of these the well-known B.S.A. is the best.

The rook rifle was necessarily an arm of limited range, meant for safe use in populated country sides. The calibres were, therefore, reduced and the cartridges are in general simply rather longer versions of the ordinary calibres of pistol cartridge. Rook rifles are seldom made nowadays. The following were the usual varieties:

·380 long.
·360/No. 5 (a modified ·380).
·320.
·300 a long rook rifle cartridge.
·295 or ·300 pistol.
·297/250 Jeffrey's.
·297/230 Morris tube.
·22 rim fire all lengths.

Most of these were originally made in rim as well as central fire, and are paralleled by the American series of:

·32/20 Winchester.
·25/20.
·22 rim fire, all lengths.
·25 Stevens' rim fire.
·30 rim fire.
·32 rim fire.

The American equivalent of the rook rifle is found not only in the small bore repeaters already mentioned, but in a wide range of small single shot rifles made by Stevens Arms Co., such as the "Ideal," "Favourite," "Crackshot" and other models identical in action but varying in calibre, weight and detail.

Wesson, Ballard, Remington, Winchester and many second grade firms made cheap machine-made arms for this range of low power small calibre ammunition.

Hundreds of thousands of ·22 rabbit rifles have been made and sold. They perish rapidly because the ultra small bore ·22 is difficult to keep clean and the fulminate of the rim fire cartridge is peculiarly corrosive. A very large collection of ·22 rifles alone would take a lifetime to make and it would be almost impossible to keep pace with detail variation.

A peculiar arm sometimes met with is a hybrid air gun of the spring compression type, which is alternatively adapted to fire a ·22 cartridge. Ignition is effected by a striker pin on the air plunger head. Such guns were made by the Quackenbusch Arms Co. from 1890 to about 1910. The same company marketed peculiar little folding ·22 rifles with a bolt striker in a swing out breech block.

The "Saloon" rifle is rather different to the true rabbit rifle, and is smooth bore. Originally these arms were known as "Carabines de salon," and were not rifled at all. They fired bulleted breech caps of Nos. 1, 2 and 3 calibre. No. 1 is substantially a ·22, No. 2 a ·300, and No. 3 a ·35. In the original bulleted breech cap there was no powder charge and the propellant was purely a stiff charge of fulminate in the rim. A spherical bullet was always used.

Saloon pistols as first made had no breech block, but employed a heavy

flat faced hammer whose inertia and the pressure of a stout mainspring acted as an adequate breech. During the eighties the Warnant breech block, a simple lift up block held locked by the hammer was applied to saloon arms, and there are many simple variations of this elementary system. Saloon guns are now manufactured in vast quantities and wide variety by the cheapest Continental factories, but find little sale in critical markets.

The Germans specialised in peculiar arms which are essentially saloon weapons meant for indoor short range practice. These rifles fire a cap of ·17 in. or less and a single small shot or ball about the size of a single B.B. shot. The weapons are frequently heavy and fitted with complicated target or orthoptic sights, and are similar in general make and appearance to a typical Continental target or Schüetzen rifle. The barrel is often of apparently large bore, but the breech section is bored for the minute indoor cap and an internal barrel about 18 in. long serves as the real bore.

In addition to rifles specifically built for the small cartridges we come across adapter systems embodying the enclosure of a small bore tube inside an arm of greater calibre. The most famous of these was the Morris tube, in which a tube bored for the ·297/230 cartridge, a short bottle-necked affair, was turned with a breech end similar to the standard chamber of the arm it was to fit and fitted with a centring plug and nut at the muzzle end. A sliding sleeve, the same diameter as the original cartridge, served as an extractor by engaging with the normal extraction mechanism of the arm. The tubes were woefully inaccurate and the cartridge badly designed, and after some years of use the invention lapsed. Practice tubes bored for the ·22 cartridge, but with the chamber at a slight angle to the bore, have since been used with better success.

The idea of having the chamber at an angle is to enable a rim fire cartridge to be fired by the central fire striker. The fact that the bullet has to go round a slight corner or angle does not appear to affect its accuracy. In general, though, adapters are not successful as a change in sighting is necessarily involved. Those adapters giving a reduced charge or a pistol cartridge of equal bore to the rifle inserted in an accessory chamber shaped like a cartridge are of little use, as the twist of modern rifles is too high pitched for the successful use of low velocity ammunition. Adapters for

a cap and single pellet are made for automatic pistols in Germany but are not accurate.

In general we may take it that the black powder weapon became obsolete during the first decade of the present century. The change occurred first in shotguns, then in military rifles, and sporting rifles followed very quickly. The last weapons to be affected were the small rook rifles and the revolvers, for most of these had already an adequate margin of safety which allowed them to be used with smokeless or nitro powders with no essential variation of design.

The passing of black powder closes an epoch and introduces not only a smokeless powder era, but the satisfactory development of a new principle, that of automatic or self-loading arms.

CHAPTER IX

THE SHOTGUN

THE shotgun has to be separated from other branches of firearms' design, not because there was less ingenuity spent on it, but because it does not represent any particular ballistic advance. Rifles and pistols advanced mechanically and ballistically, but the shotgun, despite sixty years of breech loading usage, shows relatively very little ballistic advance over the best of muzzle loaders. Our guns to-day throw a closer pattern of shot, have possibly, though not certainly, a material increase in range due in part to smokeless powder, in greater part to choke, and their design, having passed through a turmoil of rival patents, has at last settled down to established patterns varying only in unimportant detail. We could do with a new genius like Manton to quicken to life again the art of gun design which for the moment we deem so settled that no place for improvement can be found.

Repeating guns and automatic guns have been designed and made in some quantity in America and Belgium. Public opinion has never been kindly towards them, not because of their clumsiness and doubtful efficiency, but because of their peculiarly unsporting nature. The repeater and the automatic shotgun must necessarily be chronicled ; they may even be used for duck-shooting in wild countries where the pot is the chief consideration, but they are never used by sportsmen. Even in the U.S.A. popular opinion is crystallising in favour of more sport and less slaughter, and they are slowly beginning to be looked upon as bad form. These considerations are ethical rather than practical, for a skilled game shot, using two guns, can fire four accurate shots quicker than he can with these mechanical repeaters, which are slower to operate than any double barrel. The trigger operated automatic is in another class ; this in the hands of a good shot is a very perfect slaughtering machine and fires five shots

as fast as trigger pressure can function. As the object of shooting with a shotgun is sport, the automatic shotgun cannot be classed as any improvement, and its continued manufacture is to be strongly deprecated.

These strictures may seem to bear hardly on the Americans, who in their turn condemn us for our occasional use of punt guns, little knowing the prodigious discomforts and by no means negligible hazards that attend this branch of sport.

The range of calibres used in shotguns varied from the mighty 4 bore of ·977 through 8, 10, 12, 14, 16, 20, 24, 28, 32, ·410 down to the ·22 saloon guns which fire tiny shot cartridges the size of a bulleted breech cap.

In the old muzzle loading days 14 bore was the normal standard, and the 12 bore we use to-day is really a 14 bore, so far as the barrels are concerned, but as it was chambered out to take cartridges when breech loading came in, it took the bore size from the unreduced wads which fit the cartridge. These are true 12 bore in diameter. In the same way the multiplicity of calibres had been reduced. Four bore and 8 bore are occasionally still made for special orders, but are obsolescent in that guns for them are seldom, if ever, made for stock nowadays. Ten is obsolete, as are 14, 24 and 32. The calibres in current use are limited to 12, 16, 20 and 410, while the 28 is seldom used except in the U.S.A., where it is a favourite for quail guns. Further limitation of calibre may be looked for because the 20 bore cartridge is open to a particular objection. It drops into a 12 bore chamber, but lodges at the cone and will not pass through the barrel. In this position it allows a loaded 12 bore cartridge to be dropped in behind it. When this error is made, and it is fairly frequently made when 20 bore and 12 bore cartridges are kept in the same gun room, a bad burst dangerous to life is the inevitable result. If a boy's gun is being selected it is wise to give preference to the 16 bore in place of the 20 bore in order to avoid this danger.

The standard modern shotgun shows no material variation in the outline of stock or in its measurements from the classic form devised by Joe Manton. The introduction of breech mechanism and hammerless locks has made the modern breech loader rather heavier than the old light muzzle loader, and quick modern powders now enable us to shorten the barrels to 25½ in. in place of the conventional 28 in. or even 30 in.

barrels of the black powder muzzle loader. The last vestige of the old guns, the hammers, are now obsolete and hammer guns are only made in the shoddiest lines of trade guns.

The progress of invention was rapidly applied to shotguns, for there is a very much larger demand for shotguns than for rifles. The history of the latter is determined by military needs, and progressive invention applied to the shotgun in many cases anticipated its development in rifled arms. There is, however, such a wide difference between the essential use of a shotgun and a rifle that it is necessary to remember that a shotgun is still a light weapon with thin barrels, incapable of standing high pressures. Its purpose is to throw a comparatively weighty charge of small shot, which scatter over a certain area, in a circular pattern which widens out with the range. The charge is propelled at a comparatively low velocity compared with a rifle bullet, but if we increase the velocity beyond its present limit we find a loss of the pattern or coherence of the charge and a reduction of its efficiency which in no way compensate for the slight increase in range. For general use it is very doubtful if any improvement in the shotgun which achieved much greater range would be of any value. There are very few shots who can successfully use a modern gun to the limit of its sixty yards range as it is. The balance of probability suggests that it will require a new major invention, probably in connection with propellants, if any further great advance is to be made in the shotgun as we know it to-day in its latest development of the short 25 in. barrel invented by Mr. Robert Churchill.

We owe the popularisation of the new universal drop-down action to Lefaucheux. It had been invented many times before, and in many forms, but Lefaucheux introduced the drop action with two novelties, the pin fire cartridge and the forward under lever beneath the fore-end operating a bolt in the action engaging with a hook or block attached to the barrels. Arms identical with the original Lefaucheux gun are still made in France in cheap varieties, and though weak are crudely serviceable. It was introduced in France in 1850 and brought to London by the gunsmith Lang, of Bond Street, in 1851.

The development of the standard double-barrel breech loader falls into the following successive steps. First the evolution of a sound rigid breech fastening and a conveniently placed opening lever, second the

evolution of hammerless or rather internal strikered locks, thirdly the evolution of the self-ejecting mechanisms to eject the fired cartridge.

These steps do not fall into precise chronological order, in so far as the first early attempts to attain these results are concerned, but they represent the succeeding general phases of inventive development applied to the perfection of a rudimentary principle evolved by a predecessor.

The designers of the early breech loading shotguns had to meet criticism from a public little informed and far less capable of appreciation of mechanical principles than the public of to-day. The cartridge was an innovation. Breech loaders, as at first introduced, had a bad reputation for shooting very weakly in comparison with the equivalent muzzle loader. This reputation would seem to be due to the fact that the earliest breech loaders were very often not properly chambered and accommodated a paper cartridge whose exterior was the same size as the internal diameter of the barrels. As a result there was gas escape and inadequate wad expansion, and the guns must have shot weaker than a tight wadded muzzle loader. Lefaucheux' first all-metal cartridges were difficult to extract. The combination of paper case and metal base which succeeded was far better, but even this had disadvantages. There was often gas escape round the pin, and all too often the metal cap separated from the paper cylinder. The first Lefaucheux and other pin fire guns had no extractor mechanism, and the empty cases had to be pulled out by a little hook tool carried separately. This fitted the pin of the case, and enabled the cartridge to be cleared even if it fitted tightly enough to resist finger extraction.

Lang's introduction of the Lefaucheux gun made a great sensation. It was immediately taken up by progressive sportsmen, and it is not easy for us to realise what a revolution it meant. Prior to the introduction of breech loading the sportsman went out in an intricate panoply. Powder flask, loading stick, shot of different sizes in different chargers, or two hollow leather shot belts sagging from the shoulders, percussion caps loose in one waistcoat pocket, wads in another; halts and delays in the advancing line while reloading took place; in wet weather hang fires; in moments of excitement enthusiasts firing away their ramrods. And always a very real element of danger due to one barrel "going off by accident" while the other was being reloaded. The hand had of necessity to be in front of the loaded barrel during this operation.

With the Lefaucheux one half-cocked both hammers, twisted the lever so that the breech fell open, and dropped in the self-contained cartridges. No wonder the new system found immediate adherents. It was a revelation.

The counter attack was violent. Breech loaders were condemned as weak shooting, unsafe and dangerous novelties. Controversy raged until the Field Gun Trials of 1858 showed the breechloader to be very nearly as effective as the best muzzle loaders and capable of firing even heavier charges.

Lang soon modified the original Lefaucheux to an action in which an eccentric bolt lever forced the barrels back upon projections fitting the chambers, thus establishing a very solid gas-tight breech not likely to shoot loose with wear. This type continued until 1863, but suffered from the disadvantage that when opened the barrels had a curious loose feel, owing to the forward movement necessary to clear the breech plugs involving a slotted hinge lug.

The pin fire action was not ideal for there was often gas escape around the pin. The cartridges were liable to accidental discharge, and the extraction system of pulling them out by the pin was troublesome.

In 1852 Charles Lancaster brought out his central fire under lever gun with extractor. This arm is far closer to modern standard practice than the very elementary Lefaucheux.

The true central fire cartridge as we know it to-day did not appear till exhibited by Daw at the Exhibition of 1861. This gun had the ordinary hammer action with oblique percussion pins hit by the head of the hammer. In Lancaster's original model the strikers were central and driven forward by the breast of the hammer.

By 1861 breech loaders were coming into general use. Discussion now centred, not on the relative value of the breech versus muzzle loading, but on the best breech loader. Up till then the lever actions had not been self-closing, but needed to be shut by a separate movement. The period subsequent to 1861 is prolific in "snap" actions, which close automatically with the arm, and sees the invention of the "doll's head," the projection of the top rib which locks to the standing breech, by Westley Richards, and its improvement by a cross bolt by the original W. Greener.

Under levers gave way to side levers and eventually to the top lever.

The original single hook bolt was modified to the double "grip," which engaged two hooks by means of a screw, and this in turn was superseded in 1867 by the Purdey bolt action, the familiar slide and top lever arrangement in common use on nearly all guns to-day.

Locking systems of various degrees of complexity followed in swift succession. The *Field* newspaper added a good deal to the difficulties of gunmakers by insisting on a complexity of useless safety devices, and at last the eminent shooting editor, Mr. Walsh, sponsored a grotesque invention of his own with the hinge beneath the strikers. It was marketed by Bland in 1880 as the "Field" gun. It was a failure.

The period from 1860 to 1875 was one of stabilisation of the design of the hammer gun, but already the hammerless gun was experimentally marketed. As early as 1838 there had been Needham's needle fire gun with double bolt actions. This was a marvel of ingenuity, but not particularly practical. There had even been earlier percussion guns with concealed hammers, and Paczelt's hammerless flint lock of 1738.

From 1865 onwards a variety of devices were applied by Harrison, Pape, Greener, Lang, Holland and other makers, which provided for the mechanical cocking or half-cocking of the hammers either by leverage of the falling barrels or by the movement of the opening levers. The first true hammerless gun appears to have been that of Murcott of 1871–1872. In this, forward pressure upon a lever in front of the trigger guard pressed back two internal strikers projecting from modified side locks and withdrew the barrel locking bolts. A few early variations by Silver, Scott, and Gibbs appeared, and then in 1876 appeared what is perhaps the most widely used shotgun lock and action ever designed—the Anson and Deeley hammerless action.

In the Anson and Deeley and its many modern modifications the revolution of the opening barrels about the hinge pin caused a lever to lift a forward projecting tail on the tumblers or "hammers," so that these in turn are rotated about their axis against the pressure of the main springs until the scears can fall into the notches or bents. There are only four pieces in the action, and it represents a simplicity unsurpassed to-day. There are many variations which do not perhaps come within the scope of the original patent but may be looked on as applications of the principle.

The alternative to the solid frame action or Anson and Deeley type of lock is the side lock. This offers no practical advantage over the Anson and Deeley, but is rather more graceful, and lends itself to the construction of rather better balanced and more pleasantly handling shotguns. Many of these as made by makers to-day vary very little from those of fifty years ago, if indeed the workmanship is as good.

These side locks were originally cocked by the opening movement of the top lever, but this required considerable force. In general, systems soon worked down to those in which the opening of the barrels operated a lever to cock the lock, and those in which the function of closing the barrels effected the cocking.

The principle of using a projecting limb to extract the cases far enough for them to be gripped with the fingers and withdrawn dates from the original Daw central fire gun. In 1879 it occurred to Needham, a Birmingham gunsmith, to improve this to the point of flipping out or ejecting the cartridge. The Needham ejector consisted of a pivoted lever with a projecting tail, which was hit against the breast of the tumbler when the gun was opened, and so jerked the cartridge out. It was selective in that only the discharged cartridge was affected, as in the cocked barrel the tumbler breast cleared the end of the lever. This system was soon modified by various makers, and embodied in less crude form in their locks. It was not until 1878 that the principle of applying a separate small additional spring lock to each barrel, whose only function was to eject the case, was first evolved by Perkes. This was followed in 1886 by the Deeley ejector, which was the first in which the modern self-ejecting mechanism functioning independently for each barrel was used. In essence the ejector mechanism consists of a small separate lock beneath each barrel, and carried in the fore-end. This lock is discharged by the tumbler cocking lever of the gun lock of the discharge barrel when the action is opened. Until about 1893 ejector mechanisms were frail and unreliable and were not regarded as they are to-day as essentials to any good quality weapon. There were many variants of differing degrees of complexity, and almost every gunmaker either had his own patent, varying slightly from somebody else's, or fitted some recognised trade model under licences from the makers and patentees.

In America, invention which had been so prolific in the case of rifles

OLD PROOF MARKS AND GUNMAKERS' MARKS OF BRITISH MAKERS

1. Saml. Love, *c.* 1680.
2. Occurs on arms by W. Simpson, Willmore, Collumbell and G. Jones. It is believed to be the mark of Foad, a barrel maker of Tewen Street, who was working in 1689. Variant forms of the crown occur.
3. Lowe, *c.* 1700. The mark resembles the standard viewers' mark, but the V is much smaller and the crown of peculiar high topped shape. Possibly a spurious contemporary mark applied to an imported weapon.
4. Wallace, Dublin, 1780.
5. D. Moore, London, 1790.
6. T. Peele, Whitehaven, *c.* 1730.
7. Griffin and Tow, *c.* 1780. Occurs on earlier pieces.
8. William Turvey, London, 1720–1760.
9. Fleur-de-lys, often coupled with the above (No. 8), but associated with a number of Birmingham marks.
10. Utting, Birmingham, *c.* 1800.
11. Heylin, London, *c.* 1780.
12. W. Grice, *c.* 1760.
13. I. Parr, London, *c.* 1700.
14. E. D. Nicholson, *c.* 1790.
15. James Freeman, *c.* 1710.
16. Birmingham viewers' mark subsequent to 1813.
17. Birmingham proof mark subsequent to 1813.
18. Variant of No. 2.
19. Barbar, London.
20. Variant of No. 19, both I and L associated with B appear on Barbar pieces.
21. Brander, London, *c.* 1750.
22. Jos. Stace, 1680.
23. Brooke, London, 1685. Also on pistol by Clarkson, London, *c.* 1680. Occurs on James II muskets.
24. T. Green, London, 1702–14.
25. On pistol by Perry, London, *c.* 1780, but probably later mark of Griffin and Tow.
26. On pistol by R. Coffin, London, *c.* 1770.
27. Variant of No. 11. Heylin, Cornhill, *c.* 1750.
28. John Hawkins (Senior), London, *c.* 1680–1714.
29. Waters, London, *c.* 1750–76.
30. Walker, London, *c.* 1690. The star may be a trophy of arms like No. 13.
31. London proof mark from 1672 onwards.
32. London viewers' mark from 1672 onwards. Both these are bold early stamps, about 1700. They vary in form and become finer later.
33. On R. Edge pistol, London, *c.* 1725. Compare No. 25.
34. Charles Pickefatt, London, *c.* 1675.
35. Isaac Freeman, London, 1683.
36. Probin, London, 1718.
37. Bumford, London, *c.* 1700–1740.
38. R. Wilson, London, *c.* 1780.
39. Richards, London, *c.* 1700.
40. Fisher, London, 1685–1689.
41. Crude Dublin, proof mark on Rigby pistol, *c.* 1820.
42. Elias Cole, London, *c.* 1700–1716.
43. T. Twigg, London, 1775.
44. See 1, 2, 18.
45. Dublin proof mark of about 1750.
46. Dublin viewers' mark of about 1750.
47. Fleur-de-lys, associated with many makers, probably a distinctive barrel maker's mark.
48. Unknown *c.* 1690, but probably Towle, a family of musket makers.
49. R. Brooke, 1685–1689. Also on Clarkson pistol *c.* 1680, see No. 23. Several Brooke names occur.
50. T. Fort, 1702–1713, London.
51. Waters, London, 1740–1760. On Scotch pistols.
52. Private proof mark of Ketland of Birmingham, which later developed into the Birminghm proof house mark.
53. W. Arden, Dublin, *c.* 1710.
54. R. Wilson, London, *c.* 1740.
55. Farmer, London, *c.* 1730–60.
56. Tower viewers' mark on Farmer lock, 1753.
57. Dupe, Birmingham, *c.* 1790.
58. Joseph Manton, 1810. A shield inlaid in platinum.
59. On Birmingham weapons, *c.* 1780.
60. Archer, Birmingham, *c.* 1790.
61. Double proof, but no viewers' mark on brass pistols by Knubley and others, *c.* 1770.
62. Barbar on pistol silver marked, 1747. Compare Nos. 19, 20.
63. On pistol by Coffin, *c.* 1770. Compare No. 26.
64. On Collumbell pistol, London, *c.* 1720.
65. Variant of No. 35.
66. Unknown, but possibly Italian.
67. Mark of Migona of Pistoia on Italian barrel mounted by No. 68.
68. Thos. Richards, Birmingham, 1760.
69. London, *c.* 1690, unidentified.
70. Birmingham private proof of Ketland, *c.* 1780.
71. Ditto. The crown shows change from No. 52.

F 1
F 2
V 3
SW 4
DM 5
TP 6
IG 7
WT 8
9
I·U 10
IH 11
WG 12
13
IN 14
J·F 15
16
B C F 17
F 18
LB 19
IB 20
WB 21
IS 22
RB 23
TG 24
G 25
TH 26
IH 27
IH 28
IW 29
W 30
31
V 32
L 33
CP 34
IF 35
IP 36
IB 37
38
RW
39 IR
40
P 41
EC 42
IT 43
F 44
P 45
V 46
47
T 48
RB 49
HT 50
IW 51
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WA 53
RW 54
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1 57
JOSEPH MANTON PATENT 58
59
D 60
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LB 62
T.H 63
G 64
IF 65
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B 67
T·R 68
GH 69
70
71

and revolvers, introduced the repeating principle to shotguns. In other respects, so far as concerned the double-barrelled gun, they followed English design, but attempted to make their weapons by machinery. Colts' made some astonishingly bad and heavy double guns. The Winchester Company made falling block single barrel arms. Stevens and many other companies, such as Smith's, Parker and the Ithaca Firearms companies made heavy single and double-barrelled guns which were reliable and well suited to farmers' use. But America had never yet been able to approach European standards as set by British gunmakers for the all-embracing reason that the machine tool cannot entirely replace the perfect workmanship of skilled craftsmen. The machine-made gun is necessarily more mechanical and less refined, and as a shotgun has to be fitted to a user like a suit of clothes, it is hopeless to expect the factory product to approach the individual weapon in efficiency.

The repeating shotgun had long been a favourite of American fancy, and some of the Colts' earliest revolving arms were revolver shotguns. The Colt shotguns of 1840 were followed by another revolving system, North's and Skinner's gun, made at Middletown, Conn., in 1852. These were muzzle loaders or chamber loaders. In 1855 Weaver's single shot shotgun, made at Windham, Conn., appears. In this arm the barrel was pivoted laterally; it was hammerless and cocked by an under lever similar to the Winchester form, and embodied a Maynard tape primer and used a self-consuming paper cartridge. It represents features in advance of its times.

The first cartridge repeater shotgun appears to have been the Roper of 1866, which was a 16 bore four shot repeater in which the cartridges were held in a short tubular magazine beneath the barrel, and fed from it to a revolving carrier beneath a long lever operated bolt, somewhat similar to the Winchester rifle. This bolt passed them to the chamber. The weapon was, however, unhandy, and was superseded by the Spencer repeating shotgun, a modification of the original Spencer carbine in which the butt magazine was replaced by a tube magazine below the barrel, and the original under lever or trigger guard lever replaced by a sliding fore-end moving along the tube magazine. This is popularly known as the "Trombone" action.

The Spencer repeating shotgun was the first successful repeating shotgun, and represented a new departure. Attempts were made to popularise

it in England in 1886, but it was not favourably looked on and proved on test to be only capable of eighteen shots per minute, as against the thirty a minute of a double-barrelled ejector of equal calibre. A contemporary European repeater was the Larsen, but this was even slower. The only multi-shot shotgun made in England was Lancaster's four barrelled gun, a weighty affair on the principle of his four barrelled pistol. The internal revolving hammer was cocked for each shot by a double action trigger, similar to that of a revolver. It was purely a freak arm.

In 1887 the first Winchester repeating shotguns were introduced. These were very similar in principle to the Winchester rifle and were operated by an under lever. In 1893 a new model on the trombone principle was issued, which was improved in 1897. In 1912 they produced the first hammerless repeating shotgun.

The Marlin Firearms Co., the Stevens Arms Co., the Burgess Arms Co., the Remington Arms Co., and the Savage Arms Co., have all produced repeating shotguns, very similar to the standard Winchester type. The modifications and improvements have been mainly in the direction of enclosed strikers in place of the hammer and side or bottom ejector of the empty case, the application of the "take down" principle so that the gun can be taken apart for travelling, and the incorporation of small safety devices and refinements. In general these arms are heavy, poorly balanced, and compare unfavourably with double guns of very moderate quality. On the other hand they are reliable, shoot well, and represent the best value for small money that the American sportsman can buy—for there is a very heavy import duty on good foreign-made guns sent to America.

The most important factor in the development of the shotgun during the late period of the 19th century is not so much the evolution of any new mechanical device as the enormous improvement brought about in the shooting qualities of all guns by the discovery of choke boring. From very early times various gunsmiths in different countries claimed to have discovered methods of making their guns concentrate a charge of shot in a given area at forty yards range. The percentage of pellets so concentrated varies very widely, and a variation of a few thousandths of an inch in the barrel diameter makes a very distinct difference in performance. In point of fact a choke is produced by constricting the diameter of the bore just before the muzzle is reached. A narrowing of the bore here will produce

a greater concentration of shot in a 30 in. circle at forty yards than will be produced if the same gun is fired with the same charge, but with the barrel tapering in internal bore, bored true cylinder throughout, or relieved (that is to say expanded) at the muzzle.

Choke is still regulated by trial and error methods. Why it acts is not known, though modern theory[1] is inclined to believe that the shot charge being deformed by pressure during its passage up the barrel changes from a collection of spheres to a collection of deformed pellets, in which surfaces under pressure are changed to adherent slip planes. A quality of planes at a range of angles up to about 32 degrees is that under high pressure definite adhesion of surfaces take place. Relative movement or sliding between surfaces normally subject to movement when no stress pressure is applied does not occur. The function of the choke is to disturb this cohesive effect, and the shoulder or " lead " into the constriction provided the necessary jar while the passage through the constricted area lasts long enough for the rearrangement of pellets to be such that before fresh adhesions are set up, which would be laterally dispersive when the charge passes from the muzzle into the air, the pellets leave the barrel with a majority freed from pressures likely to cause them to deviate from the main direction of the flight of the charge.

If the constriction exceeds a reduction of normal barrel calibre by forty thousandths of an inch fresh stresses are caused, and excessive choke again spoils shooting power and causes a scattering of shot worse than that of cylinder bores. The boring of a barrel with a slowly contracting bore equivalent to a choke in diameter, but devoid of the relatively abrupt shoulder or " lead " into the choke, is also ineffective.

It appears extremely unlikely that any of the makers of muzzle loading arms knew of this principle. They were accustomed to bore guns " tight behind " or " tight in front," that is to say, with a slightly coned breech, or with a breech bored rather larger than the fore part of the barrel, but this was for convenience in loading when fouling had accumulated rather than with any deliberate conception of enhancing shooting powers. The only exception to this I have noted is the curious 1738 hammerless flint lock by Paczelt, which had a choke or thimble of steel brazed in at the muzzle. Whether this is part of an internal liner or chemise to the barrel

[1] Pollard, *Modern Shotguns*.

and merely an "accidental" choke is impossible to say, but the balance of probability suggests that muzzle constriction would not be intentionally applied to any muzzle loading arm. In many muzzle loaders the bore was constricted below the muzzle, and in front of the chamber, but usually about half-way down the barrel. This gave rise to the French term *étranglé* or choked, and the term choke applied to a constriction later applied to choke boring proper where the constriction was at the muzzle.

Claims have been made for an American origin for choke boring, but these have never been proved, and there is no doubt that it was the invention of Pape of Newcastle in 1866. He did not realise its possibilities and neglected publicity. The reason seems to be fairly clear. Pape could make guns on this system which would shoot closer than other guns of the period; but his customers were not all perfect shots, and probably got more satisfaction out of close range work with a wide scattering range of shot than out of a more perfect tool. To-day full choke is seldom used except on duck guns or weapons built for special purposes. In 1875 trials were held which proved the vast superiority of choke boring over plain cylinder tubes. Two main systems were entered, the choke bore as we know it to-day, popularised by Pape and Greener, and the "recess choke," or tulip choke, now obsolete. In this the barrel was slightly contracted in the form known as "modified cylinder," then instead of being contracted was expanded into a recess an inch or more long, which in turn was again contracted to a muzzle piece of the same size as the entry to the recess. In effect it shook up the pellets, but was materially less effective than the true choke system. This has again been modified into short and long chokes according to the ideas of the various makers, but in practice gun barrels are altered by trial and error until they give the requisite performance. No formula or calulation can give more than an approximate result. Machine-made barrels hardly varying a thousandth of an inch show a wide range of different results.

These early breech loading shotguns were designed for and used with black powder. All elements or margins of safety in construction, dimensions and quality of material were based on black powder considerations. Barrels were made of iron, or iron and steel mixtures, and were of great variety. In general the principle of making figured or Damascus barrels depended on the twisting together of rods of iron and steel which was later hammered

out into a band. In the cheapest quality of shotgun barrels a single bar of iron was twisted, then hammered hot into a band, coiled in a spiral round a mandril and welded together at the edges of the spiral. Better and more expensive qualities were formed by twisting three, four, five and six alternative rods of steel and iron into bands. The degree of twist and the order in which the rods were arranged varied the external pattern shown by the fibre of iron and steel. The latter, being harder than the iron, is less affected by the acid used in browning the barrels, and showed the figuring of the metal. Deep etching with acid leaves the steel fibre in high and beautiful relief.

Little by little steel superseded iron in the gun barrels, and the beautiful but expensive Damascus was superseded by plain steel tubes which were both cheaper and could be made strong enough to resist the effect of smokeless powder without having to be made unduly heavy. The steel barrel is in universal use to-day, and enables a light shotgun to be made to withstand charges which would necessitate Damascus barrels many ounces heavier.

Smokeless powder was manufactured in England from nitrated wood sawdust, on the basis of the Schultze patents, early in the 'seventies and was issued as a substitute for black powder. The early issues were very variable and were not graded or grained, but consisted of varying sized nitrated sawdust. The properties were not really understood even by manufacturers, and the scientific basis of grain size in slow-burning propellants had not been discovered. Good samples were, however, quick and effective and a certain amount of public support was gained. In 1878 the powder was improved by using wood pulp, and graining the resulting mass into granules varying but little in size. Trials held showed that Schultze powder possessed a slight advantage over black powder. The company, however, altered their formula next year and produced a rather dangerous batch giving pressures too high for the guns of the time. There were some accidents. In 1882 E.C. powder was introduced. This had a cotton in place of a wood basis, and was more reliable than the Schultze. In 1888 the Rules of the Proof House were amended to include a supplementary proof for guns to be used with nitro-powder. In 1890 nitro-proof was made compulsory.

Smokeless powder was not generally adopted by sportsmen until the latter 'eighties, and black powder continued in decreasing use until the close

of the century. The delay was not due so much to defects in the powder as to defects in the loading. Country gunmakers all loaded by measure in place of by weight. To-day cartridges are loaded by weight, for even under the best conditions of manufacture smokeless powder varies a little in strength with every batch. The use of smokeless powder in sporting guns was a great advance in convenience. With the old black powder the discharge of a first barrel on a damp and windless day frequently produced a cloud of smoke which obscured the shooter's view to such an extent that he had to change ground before he could fire his second barrel.

In addition, the task of clearing out fouling after black powder is messy and smelly. In black powder days the gun room smelt of sulphur products, and the guns, now an ornament of the library, had to be kept in meaner quarters.

Although smokeless powder was first used for shotguns it was in general use for a decade or more before it was applied to rifles. This was because the original smokeless powders were bulk for bulk about the same as black powder, an indispensable provision when all charging was done by measure. In rifled arms they proved both dangerous and unsatisfactory. The loose grains tended to burn or explode far too rapidly under the heavier restricted pressure of small bore projectiles, and dangerous breech pressures and bursts occurred.

The original French Vielle powder was neither regular in action nor safe in storage. It was not until science had discovered a means of gelatinising nitro-cotton into flakes or cubes, stamped or cut out of thin sheets, that a satisfactory smokeless rifle propellant was developed.

In America and on the Continent pure nitro-cellulose powders were used. The British service selected cordite, an explosive in which nitro-cellulose was blended with a little nitro-glycerine into an elastic compound which could be shaped into fine cords or rods of different diameters for different uses in cannon rifles or revolvers.

These military propellants are all "dense" explosives, taking far less space than an equivalent quantity of black powder. Their rate of explosion is determined by the shape and size of the grain, rod or strip in which they are manufactured, and they are not suitable for use in shotguns.

The change from black to smokeless nitro-powders was completed in practically all arms by the turn of the century, and 1900 may be looked on

as inaugurating the new era of high power, high velocity rifles and the use of quick reliable smokeless powders in shotguns.

It also introduced the popular application of the automatic or self-loading principle for small arms.

From the collector's point of view, few breech loading shotguns present variations worth collecting. Needham's and Bacon's early guns are of interest. Dougall, 1868, evolved a sliding barrel system which represents an improvement on Lang's original design. Gye's shotgun has fixed barrels and a curious side-moving breech still used in some French guns. Early single and double-barrel muzzle loading shotguns by good makers like Manton and Egg are, however, increasing in value and are ardently collected.

CHAPTER X

SELF-LOADING AND AUTOMATIC ARMS

THE discharge of any firearm is accompanied by a great deal of surplus energy, which is consumed or dissipated in the recoil of the piece, and by the expansion of the powder gases in the air. The problem of how to utilise these sources of energy, either by trapping some of the expanding waste gases or by storing up the energy of recoil in spring devices, and using the energy thus trapped to clear, reload and discharge the arm, seems not to have attracted any wide attention prior to the end of the 19th century. The solitary exception is the record in the *Transactions of the Royal Society*, 1663–1664, chronicled in a previous chapter on firearms in the 17th century. This record was found by me in December, 1924, but does not indicate whether gas or recoil was to be used to function the weapon.

I have not come across any intervening reference to the automatic principle until we reach 1856. Then E. Lindner filed a specification[1] in which a gas operated piston beneath the barrel is used to free and raise a hinge chamber block to receive a paper cartridge. The arm is not self-cocking and has to be fired by a separate percussion cap. The principle, which he appears to have discarded in subsequent specifications is, however, a clear application of automatic breech opening. Following this come certain unsubstantiated legends—I quote from memory, having only been told this many years ago by an old gunmaker—that Starr, of New York, experimented in the 'sixties with a self-cocking muzzle loading revolver, utilising the recoil to revolve the cylinder and cock the arm. No trace of this seems verifiable from American sources, but one or two curious patents of about that date relate to clock springs, and trains of wheels in the handles of revolvers, designed to function the arm by spring action or clockwork,

[1] Pat. No. 1415.

rather than by true automatic methods. Savage, however, appears to have experimented with Fassold about 1877. We find a note of an automatic rifle of sorts invented by Regulus Pilon in 1863.[1] This appears to be a modified saloon rifle, firing a cartridge ignited by an external cap. A rearward movement of the barrel recoil cocked the hammer, but no magazine action was fitted. In 1866, W. T. Curtis patented a peculiar automatic magazine rifle, which was carried with its breech projecting backward over the shoulder. It could be used as a bolt action arm or alternatively as a gas-operated machine gun, the powder gases operating a piston to function the arm.[2]

Later specifications of Plessner, 1872 (American), and Lutze, 1874, (an American automatic pistol with a forward moving barrel) carry on the chain, but a more important arm was to be the sponsor of the principle. From the sixties onward we come across machine guns, that is to say, weapons which were in those days ranked more as supplementary to artillery than as an infantry weapon. Since the recent war, we have now definitely established that the machine gun is in reality a heavy type of automatic rifle, but during this early period the machine guns, beginning with the Gatling gun and the Montigny mitrailleur, were ponderous multi-barrelled devices which were little more mobile than light artillery, but ought to have been tactically employed at infantry ranges. This point was entirely missed by the gunners of the seventies. The French never grasped this essential point, and the tactical handling of the mitrailleurs used in 1871 was woeful. These early machine guns are outside the scope of a book on hand firearms, but it is important to point out that they were not automatic. In general they were fed from a drum or hopper, and operated by a handle at the side. They were called "coffee grinders," and it is not a bad description. Their purpose was to distribute a high speed imitation of volley firing, and they were not necessarily to be regarded as weapons of precision, a nice "zone of dispersion," consequent on mechanical defects, was looked on as an advantage. It enhanced the sprinkling effect. The Hotchkiss revolving cannon, the Gardner, the Nordenfeldt, and many others were of this handle or lever operated type with many barrels. In the end the Gardner was simplified down to one, and was

[1] Pat. Spec. No. 2998.
[2] Brit. Pat. Spec. No. 1810, 1866.

a fairly effective arm, but it was always a piece of position, or on a wheeled carriage, and was never a shoulder arm.

The machine gun filled a long-felt want. Mr. Maxim was visiting the Exhibition of Electricity at Paris in 1881, and proceeded to Vienna, where he met an American Jew, who said with the acumen of his race and his country: "Hang your chemistry and electricity! If you wish to make a pile of money invent something that will enable these Europeans to cut each other's throats with greater facility." [1]

This magnificently frank speech, representing the quintessence of the best commercial sentiment of the Old World, enhanced by the curt precision of the New World, had its effect on Hiram S. Maxim. He had money. Shortly afterwards he established an experimental workshop at 57d Hatton Garden.[2]

Maxim's first patent, 1883,[3] was for shoulder rifles. A loose spring supported heel plate to standard rifles, such as the Martini and Winchester, was arranged by a series of jointed levers so that the recoil of the piece against the shoulder of the firer operated the normal loading lever. When the recoil pressure ceased, the action of the spring then pressed the arm away from the shoulder and closed the action. In addition the specification shows a "blow back" fully automatic rifle, fed by a revolving magazine of Mannlicher-Schönauer type.

The term "blow back" is applied to automatic arms, such as the majority of pocket pistols, in which the breech loader is not secured to the barrel by any form of mechanical loading device, but depends on its own inertia and the pressure of springs behind it to hold it in momentary contact with the breech of the barrel during discharge. The term "locked breech" applies to those mechanisms in which barrel and bolt are mechanically locked together during the period of firing, and either recoil together for a short space before separating or depend on a gas operated piston to release the locking device and function the action.

This locking action makes its appearance in Maxim's rifle of 1884 (8242), but was preceded by a patent[4] which utilises, not recoil, but gas pressure, so to speak, inverted; "the ejected gases cause a vacuum in a fixed

[1] Sir H. Maxim in the *Star* newspaper, 23.7.15.
[2] *My Life*, by Sir Hiram S. Maxim, Methuen, 1915.
[3] No. 3493. [4] No. 606.

chamber." This principle does not appear to have been further developed. The specification contains the genus of ideas later developed in the Maxim machine gun, notably the crank movement and the roller feed system. The 1884 rifle (8242) may be classed as a compromise between the blow back and the locked breech system. It embodies a toggle joint breech with a fixed barrel, and is rather a delay action of the modern type of blow back than a locked breech in the strict sense of the word.

The idea of automaticity seems to have developed among other inventors at the same time. We find wonderful complexities evolved by Needham and by Paulsen.[1] Most of these are for converting the existing Martini-Henry service rifle to an automatic magazine rifle, but Paulsen's 1884 specification also comprises an automatic magazine pistol with the magazine in the handle.

The first shoulder rifle in which the barrel and breech bolt have united rearward movement, as is common in most modern automatic arms, appears in the British Patent Specifications in January, 1885,[2] filed by W. Arthur, and is rapidly followed in March by one by H. A. Schlund,[3] and by a gas operated device applied to the Martini by Paulsen.

In November, 1885,[4] we find the first illustration of the typical early Maxim machine gun, but with a peculiar action involving hydraulic buffers. According to some writers[5] Maxim showed his gun with the belt loading device in 1885, but there is no record of this in the official patent specifications. The belt system of loading first appears in 1886 in a patent[6] granted to Younghusband for a peculiar repeating rifle in which the cartridges are supplied to the arm from a belt carried in a drum or reel on the body of the operator.

The Maxim was officially adopted in the army as a machine gun in 1887, and first used in action by the Colonial forces against the Matabele in 1893. In essence it consisted of a barrel and breech block recoiling locked together. At the end of the stroke the breech block separated from the barrel, the cartridge was ejected, a new cartridge moved into place, and the action closed ready for the next shot. A device allowed single trigger operated shots to be fired at will, but the main purpose of the arm was to fire so long as the trigger was depressed.

[1] No. 7995, No. 14,105, 1884. [2] No. 939. [3] No. 2937.
[4] No. 14,047. [5] *Book of the Machine Gun*, Longstaffe. [6] No. 3047.

This has led us to the separation of "automatic" arms into those which go on firing so long as the trigger is held back, and those which require a separate trigger pressure for each shot. These comprising all hand firearms should be termed self-loaders, but this distinction, valuable in a War Office manual, is liable to confuse the less technical reader who is accustomed to regard an automatic pistol or gun as an "automatic," and might be confused by the pedantry of terming trigger operated automatics self-loaders.

The automatic principle was found to be satisfactory to a limited degree for machine guns, but it was completely ineffective for hand or shoulder weapons. Patents were taken out, experimental arms made, but in general the principle did not function well. The reasons are not far to seek. Even to-day the reliability of the automatic pistol can be accurately plotted in a curve showing that the larger the charge and the greater the calibre the higher the index of probable reliability. The 'eighties were sticky black powder days, and the inventor might achieve a splendid showing on paper which went to pieces in practice. Cartridges varied in size and material. Solid drawn metal cartridges, such as we use to-day, were hardly known. Powder was weak and irregular, bullets soft and incapable of being firmly seated in their cartridges. Fouling was a curse. Even the early "coffee grinders" and the later automatic Maxim guns firing the prodigious Martini cartridge, with enormous reserves of energy and fierce recoil, used to jam with incredible frequency.

The history of automatic arms was therefore a record of failure until ammunition had been developed to a point where it was adequate to meet the needs of the new kind of arm. The automatic depended on the evolution of the small bore rifle, smokeless powder, hard jacketed projectiles and solid drawn metal cartridge cases before it could achieve success.

Even now it is not quite a success. It is perhaps established as a commercial proposition, but in this year of 1925 I know of no automatic pistol on which I would care to hazard my life in a close corner. A good revolver can be relied on, for even if the ammunition is at fault the next round can be fired, but nothing in experience would indicate that any automatic pistol can claim any great measure of reliability under even favourable conditions, let alone Service conditions. It is for this reason that the British Army is still retaining the revolver as a Service pistol.

In the category of automatic rifles we find that no automatic rifle has yet been evolved which was near enough in weight to the standard military arm to be capable of satisfactory use as a shoulder weapon. Automatic sporting rifles are made, but only for cartridges which are a feeble jest, if considered in relation with dangerous game. The largest calibre automatic rifle is the Winchester ·401, which is credited with a muzzle energy equivalent to a ton, yet has a disgraceful trajectory and loses velocity so rapidly that it is almost as dangerous to the user as to the game, if he uses it at moderate ranges against animals endowed by nature with the ability to hit back. Nearly fifty years of progress have not yet given us an automatic rifle which can be substituted for the ordinary military bolt action breech loading magazine rifle. The entirely reliable automatic pistol has yet to be made, and the automatic shotgun is not wanted. It may seem a hard indictment, but it is an accurate summary of the situation. It may, therefore, be convenient to take modern automatic arms as an unstabilised product of the last few years of the 19th century instead of placing them as the fine and perfect flower of the 20th century. They represent an evolutionary stage, something to come but not yet achieved.

The first commercial automatic small arms appeared about 1893; others may have been made as inventors' models, but a specimen can only be identified from research through the patent specifications, and it will be found that arms exist for which no proper specification was filed, and that any amount of specifications were filed for arms that never existed except on paper.

In general it may be taken that all early automatic guns and rifles, other than of ·22 calibre, had a locked breech action. Pistols, on the other hand, had both blow back and locked actions. In 1902, Von Kaisertreu of Vienna attempted a classification on lines of blow back actions, actions in which the barrel recoils with the breech bolt for a short distance, and actions in which bolt and breech together recoil to the full extent of the stroke before unlocking. This classification is not nowadays adequate as various systems, such as the Savage and the Steyr, employing rotating delay actions (sometimes classed as locking actions) have been introduced. Further variations all help to make the original line of classification put forward by Von Kaisertreu only applicable to reciprocating mechanisms.

In general a division into "blow back," "delay action" and "locked

barrel," cover all types and simplifies classification which can, if necessary, be carried into further subdivisions when need arises.

The first automatic weapon to appear on the market was the Borchardt (1893). This pistol was the predecessor of the modern German official arm, the Luger-Parabellum, a weapon that retains the same base idea of a toggle joint breech action as the original Borchardt. The Borchardt was clumsy, unwieldy, and so large that it was usually equipped with a combination holster stock for conversion into a carbine. The eight shot magazine was set vertically in the handle, and the action was both frail and complicated. When a cartridge was fired the barrel and breech bolt locked together, recoiled until a pair of lugs on the frame lifted the toggle joint action of the breech, and allowed the bolt to continue its travel independent of the barrel. The bolt thus recoiled still further, ejected the empty case and cocked the arm, then came forward again, feeding a new cartridge into the chamber, pushed the barrel forward and locked rigidly as the toggle joint fell into line.

The Borchardt was not a success, and its cartridges were badly designed, but, nevertheless, it was the ancestor of nearly all the distinguishing characteristics of modern automatics, for it used rimless cartridges, smokeless powder, nickel-cased bullets, a clip magazine in the handle and various other constructional details that still continue.

Bergmann pistol. A year later (1894) appeared the Bergmann pistol, and several different models were quickly put upon the market in succeeding years.

The military Bergmann was of 7·65 mm. calibre, and had a box magazine forward of the trigger guard. It held ten cartridges, staggered in the familiar manner of the Lee-Enfield rifle magazine. It is usually known as the 1897 model.

The breech bolt slid in the frame, but besides moving directly back in parallel alignment with the axis of the barrel, it had an ingenious arrangement which connected it to the barrel (which was free to move backwards and forwards in an external casing) at the moment of firing. The head of the bolt was allowed a certain amount of lateral play, and when driven by the recoil spring toward the barrel the whole end of the bolt was out of alignment until it passed a hook block projecting from the barrel. As soon as this was passed the pressure of a side spring, and the shape of grooves

in the frame, brought back the bolt into alignment and into engagement with the barrel hook, so that it moved forward with the barrel to the locked or firing position.

Other models of minor calibre did away with the locked breech, and were of the ordinary blow back type. Various improvements were incorporated, but the general outline and design of the arm was not greatly varied.

The Bergmann's were made in 5, 6·35, 7·65, 7·8 and other calibres. Their ammunition was usually distinguished by a number, thus the 5 mm. is the No. 2, the 6·35 the No. 4, and so on. Of all these cartridges the 5 mm. is the only one still occasionally current and the others must be regarded as obsolete, though its successor, the Bayard, incorporates much of its design and is an excellent weapon.

The 5 mm. is one of the most typical of the original Bergmann models in this pistol. The magazine was forward of the trigger guard and was of ingenious design. Cartridges were inserted either loose or in a clip dropped sideways into the open magazine recess where the flap cover was pulled down. This opening of the magazine compressed a powerful spiral spring, situated under the barrel in a small cylinder. Connected to this spring was a curved lever which projected into the magazine recess. When the clip was inserted and the magazine flap cover closed, the compressed spring was automatically released and the lever entering the open case of the clip drove the cartridges up towards the feed aperture in the frame.

The clip was then withdrawn, empty, through slots provided for the purpose in the base of the flap cover, and the cartridges remained compressed in the magazine. The clips could be kept and reloaded or thrown away, or the weapon could be loaded with loose cartridges without the use of a clip.

The weapon was loaded by pulling back the breech bolt, which was a long light slotted cylinder, working in the frame. The recoil spring was a rather long weak spiral held inside the breech bolt, and around the striker, which was a very long thin and slender steel firing pin. This was made very light, and had no spring, or arrangements for preventing the shock of the closing action firing the charge, but owing to its light weight and free play this fault never occurred.

Behind the end of the bolt was an outside hammer which was forced

MODERN PROOF MARKS

1. Tulle, French official mark.
2. Ditto.
3. Ditto.
4. Ferlach.
5. Ditto.
6. Ditto.
7. German proof.
8. St. Etienne, France.
9. Birmingham modern proof.
10. Ditto modern viewers' mark.
11. Paris proof.
12. French Government arms.
13. Old Birmingham proof on pistols.
14. Ditto viewers' mark.
15. Birmingham nitro powder proof since 1888.
16. Paris mark.
17. German proof.
18. With No. 17, double German proof.
19. Liège since 1849.
20. St. Etienne.
21. Buda Pest, double arms.
22. St. Etienne.
23. St. Etienne.
24. St. Etienne.
25. Imported arms proved in France.
26. Paris proof.
27. Belgian rifled arms.
28. Wiepert proof.
29. Ditto.
30. Ditto.
31. Vienna proof.
32. Ditto.
33. Ditto.
34. German proof.
35. Birmingham first definitive proof.
36. Spanish private proof. A spurious sign.
37. Belgian provisional proof.
38. German choke bore proof.
39. Buda Pest, single barelled arms.
40. German proof.
41. Early London proof, enclosing maker's mark in centre.
42. Birmingham provisional proof.
43. London provisional proof.
44. London first definitive proof.
45. London nitro powder proof since 1888.
46. Spanish private proof, Eibar.
47. Liège, Belgium, since 1849.
48. Liège definitive proof.
49. German smooth bore proof.
50. St. Etienne.
51. London viewers' mark.
52. London proof mark of the Gunmakers' Company.
53. Imitation Spanish or private mark not internationally accepted.
54. German calibre stamp.
55. Unrecognised private Spanish mark.
56. Variant of No. 47.
57. German proof for rifled arms.
58. Prague proof.
59. Ditto.
60. Ditto.
61. Belgian nitro proof, 1890.
62. Buda Pest definitive proof.
63. St. Etienne proof.


E 1 E 2 E 3 4 5 6 7 F 8
BP 9 11 A F 12 B C P 13 NP 15 16
BV 10 U B 17 18 19 V 14
ST ETIENNE 20 II 21 AVE 22 S E E 23
F 24 A E 25 26 R 27 28 29 30
31 32 33 U 34 35 B 36 37
W 38 I 39 40 41 42 43 44
P 46 E L.G 47 E LG 48 S 49 S 50 NP 45
V 51 P 53 10 1 54 B 55 E L.G 56 G 57
52 58 59 60 PV 61 BP 62 63

back into the cocked position as the bolt was drawn back. A side lever worked an intercepting safety, and the lockwork was protected by an easily removable plate.

To remove the barrel for cleaning, one screw was taken out, the barrel then could be turned from right to left on its seating, and withdrawn from the frame.

To remove the bolt the transverse screw holding the head of the firing pin was removed, the pin withdrawn, and then the cross bolt of steel passing through the frame and through the slotted bolt could be withdrawn, releasing the coil spring.

The pocket model Bergmann was of 5 mm. calibre and fired a special conical cartridge which had neither rim nor the ordinary rimless groove because the pistol had no extractor, and did not need one, the recoil serving to eject the empty case. It is notable that this cartridge is the smallest practical central fire cartridge made, and the bullet is smaller in diameter than the ·22, being 5 mm., that is ·196 in. It is nickel covered and penetrates about 2½ ins. of wood.

The pistol is very small and flat in the pocket, about 7 ins. over all, weight 17½ ozs., and owing to its pistol shape the butt is ready to hand and the balance in the pocket good. The trigger of the pocket model is made to fold forward of the magazine and under the barrel. In the larger types it is in the ordinary pistol position behind the magazine, but in the 5 mm. model this is impossible owing to the small size.

The larger Bergmann's vary very much, and some are provided with hair trigger and target sights. Even the little pocket model has a bead foresight, and is extraordinarily easy to shoot with.

The Bergmann suffered from faulty feeding in the magazine in its larger calibres, and another source of trouble was frequent breakage of the firing pin. If kept perfectly clean and well lubricated, they work very well, but they are not as reliable or as fool-proof as more modern weapons.

The next weapon to appear was the Mauser (1898) combination automatic pistol or carbine, the wooden holster serving as a stock attachment. This was the first really satisfactory automatic pistol to be marketed, and is in use to the present day. In this piece the barrel and breech block recoiled together for a short distance, after which the automatic check released the bolt and allowed it to continue its travel, ejecting, cocking

and reloading the chamber. The magazine was of the box type set forward of the trigger guard, and held eight cartridges, loaded into it from above by means of a clip which was held in a notch in the frame. On withdrawing the empty clip the bolt closed, automatically reloading the chamber. The lock work was remarkable, for the whole weapon could be dismounted without the use of tools, other than the point of a cartridge, and did not contain a single screw, all pieces being milled and interchangeable.

The powerful 7·65 mm. bottle-necked cartridge and nickel-covered bullet were capable of good work up to 600 yards, and the weapon was sent out with a military standard sight graduated to 1000 metres. This was for use as a carbine, the wooden holster case serving as a stock. Viewed as a pistol simply, the weight, bad balance and powerful recoil did not make it a valuable weapon as a pistol, and without its holster stock it threw amazingly high, but as a high speed, long range weapon for self-defence it was an advance on all its predecessors, and a number were used by the Boers during the Boer War.

It is interesting to note that it was with these weapons that two Russian anarchists were able to defy the police of London and initiate the memorable "siege of Sydney Street," an affair which necessitated the calling out of the troops, and raised such a popular outcry over the inefficient armament of the London police that they, too, were shortly armed with an automatic pistol of approved, but now obsolete, type.

Close upon the heels of the Mauser came, in 1898, their rivals, the Mannlicher firm, with the Mannlicher automatic, using a clip holder very similar to the Mauser clip, but with the loading into a magazine inside the handle, a type first started by the Borchardt, and popular ever since.

Mannlicher. The first Mannlicher was the 1894 model, which was not a success. This pistol was somewhat similar in appearance to the 1898 and 1901 models, but on a different principle. In it the barrel moved forward and the breech and slide were fixed. The pistol was really a semi-automatic, for it had to be cocked for each shot, though a model with a double action trigger pull similar to a revolver was also made.

In the 1901 model the breech block recoils, pulling a slide underneath the barrel where the recoil spring is held. The lock-word lies alongside the magazine, under the grips, and the whole weapon can be taken apart by hand and without tools. The 1901 model is used in the Austrian service.

The lock mechanism was not as beautifully designed as the Mauser, but its system of operation was substantially the same. Specimens of this arm are still to be found in Spain and Latin America. It holds a clip of six shots. Initial velocity, 300 metres per second; range, 800 metres.

Special cartridges are required for it, a long 7.65 mm. cartridge, and it is little known in Great Britain, though popular on the Continent.

For a while there was a halt in production while the great arms firms experimented with systems and patents. They made many experimental weapons of lesser importance, few of which reached the outside world; the "Mars," or Gabbett Fairfax, a weapon experimentally made by a British firm, is an instance of this type.

By 1898 the name of the Browning automatic system began to be heard, and soon the Browning automatic pistol of ·32 calibre made its appearance and was rapturously received by the Russian revolutionaries as ideal for assassins. Owing to its excellence in this respect it sprang into universal popularity as the latest thing in pocket pistols. The ·32 or 7·65 mm. Browning cartridge is now standard all over the world, and was further popularised by the adoption of the Browning patents by the Colt Firearms Co., whose excellent plant and material produced in 1903 the ·32 Colt hammerless automatic, a weapon much superior to the Continental made Browning.

In addition to the three great pioneer models described above we find the Dormus (1895), a cumbrous bowback clip loader, but the first to employ the now popular system of a spiral coil spring round the barrel; the Schönberger (1897), in which friction devices damped down the recoil of the blow back breech block which worked an inverted toggle system similar to the early Maxim device. In other respects it closely resembled the Bergmann.

The Roth, 1900. This is a complicated pistol in which the barrel recoils locked to the breech bolt for the full extent of the stroke. Several models were made, and in 1902 a modified Roth pocket pistol made by the Sauer works and taking a peculiar short ·32 cartridge appeared. Modern Roth pistols take standard ammunition.

The Schwarlose was another peculiar weapon in the original model of 1895. It possessed a recoiling barrel, but was later (1902) modified into a peculiar pistol in which the barrel moved forward, being retained in

contact with the bolt which moved with it by the rotation of the bullet against the rifling locking, a spiral lock device. Several variations.

The Clair, 1889. A French pistol represents the only marketed gas operated pistol. It fed cartridges from a tubular small capacity magazine in the stock to a carrier on the Winchester rifle principle. This and the breech bolt were operated by a gas piston, functioned by muzzle blast in the earlier model, and by direct gas trapping in a later system.

The Konrad Kromars, Hauff, 1898, Charola Anitua and Hellfrich, 1899, represented moving barrel types of little more than experimental development appearing prior to 1910. Paulson, Simplex, d'Arche and Raschem are similar little known pistols with fixed barrels and blow back systems.

The year 1900 represents something of a turning point in automatic history. After this pocket automatics, of varying degrees of unreliability, made their appearance, and the efficiency of the small charge small calibre pistol on the blow back system was more or less established. In 1903 the Browning model of the Colt type was issued, and in 1906 the vest pocket Browning of 6.35 calibre, forerunner of a vast mass of pocket automatics of all sorts, was issued both by Colt and "F.N.," the Fabrique Nationale d'Armes de Guerre of Herstal Liège, Belgium.

For rifles, the history of the automatic is rather different. Attempts to produce an effective automatic military rifle taking the full service cartridge of any modern arm have not yet proved successful. The Griffith and Woodgate, 1894,[1] Clausin, 1895,[2] Ross, 1896, and others represent early attempts to apply the new principle to military arms.

In 1900, Browning patents for a shotgun, since modified and marketed by the Winchester Arms Co. and F. N., Belgium, were taken out.[3] In this arm a toggle joint was originally employed, and very shortly afterwards the patent covering the Browning automatic rifle later issued as the Remington U.M.C. auto-loading rifle was taken out,[4] but these were relatively weak powered sporting arms for medium cartridge, suitable for game up to deer.

The honour of producing the first widely sold automatic rifle falls to the Winchester Firearms Company, who, in 1903, brought out a simple blow back ·22 rifle taking a rather more powerful cartridge than the usual

[1] Pat. No. 20,792. [2] Pat. No. 25,042. [3] Pat. No. 9071. [4] 1900, Pat. No. 14,920.

·22 long. It was used for the asassination of the King of Portugal by republicans. In 1905 they issued a ·32 auto rifle with a simple blow back breech and barrel. In 1907 a medium power ·351 rifle on similar lines was issued, and in 1910 a ·401 arm. These sold to the public as novelties, but were very inferior weapons when considered in comparison with repeating rifles of equal calibre, but taking ordinary ranges of cartridges efficient on game. The trajectory was extremely bad, and the self-loader, even at the short range of 300 yards, show at 150 yards a curve whose height of bullet flight is more than twice that of the conventional military rifle cartridge.

In general we may class these rifles as inferior to ordinary sporting magazine rifles. Despite their short barrels they were heavy, ill-balanced, and fired inadequate cartridges whose high muzzle velocity gave no true index of the bullet's efficiency. Velocity fell off rapidly, and the speed of fire gained by the automatic action was nullified if the arms were made as light as the conventional magazine rifle of equivalent calibre, but greater efficiency, because the time lost in reaiming the automatic was as much as it required to operate a lever action.

In the early days of the principle an idea was abroad that in automatic arms, in which the surplus energy was absorbed in springs, the force of recoil was annihilated and not transmitted to the firer. In point of physiological fact the blow received from an automatic arm is often more severe than normal recoil from an ordinary arm. The cartridge impels back the moving parts represented by the weight of barrel and breech block, and these eventually are brought to rest by the frame and stock of the rifle butted to the firer's shoulder. He therefore receives on his shoulder the energy of the cartridge, fired in an arm whose total weight is only that of the recoiling parts, plus the mass equivalent of the energy necessary to overcome the resistance of the anti-recoil springs.

Another drawback is the reduction of weight leads to a shortening of the barrel. This does not materially affect the ballistics at ordinary sporting ranges, but it introduces a new factor of noise. The noise of explosion is accentuated into a disconcerting ear-splitting crash. The same effect becomes noticeable when shotgun barrels are reduced below 24 ins. in length. A 20 in. shotgun barrel will function remarkably well (if properly bored) for a very sharp or quick powder like Coopal, but the noise is so exaggerated as to be painful to many sensitive ears.

These defects were noted in the European locked breech Mauser, and Mannlicher and Luger carbines, which were really exaggerated pistols fitted with detachable stocks. They were not satisfactory as sporting arms, although ballistically slightly better than the American products.

Modified versions of long barrelled automatic pistols were produced in carbine form, such as the Dreyse, an unremarkable blow back action which represents the ·32 auto calibre in its rook rifle form.

In 1912 the original Browning system with a sleeved recoiling barrel and a locked breech action was issued by the F.N. factory, and a year later by the Remington U.M.C. concern in America. The introduction of the locked breech enables cartridges of medium power to be used in a weapon not unduly weighty, but these arms in calibre of ·32, ·35 and ·40 are not comparable to the military cartridge, but only classifiable as suitable for use on soft skinned intermediate non-dangerous game.

These weapons are unduly complicated, and embody many small moving parts, and are not suitable to military rifle requirements.

Another venture, this time in the direction of gas piston operated automatic rifles, was that of the Standard Arms Co., U.S.A. About 1910 they issued a top ejecting gas operated repeating rifle using medium power cartridges, such as are used in the more powerful Remington self-loaders. These rifles were provided with a tap device which could be turned to cut off the gas, and then left the arm as a trombone pattern slide operated repeating rifle. The Standard was a weighty arm, and the left-hand trombone grip which could be used to operate the action was a grotesque casting in gunmetal portraying stags. A reduction in the weight of the arm by removing these masses of metal produced a weapon extremely unpleasant to fire. Weight was essential to comfortable use of the weapon, and as the weight exceeded that of convenient and more powerful repeaters the weapon failed to attract the support of sportsmen. The company failed.

Enthusiasm for the automatic principle was largely fostered by the fiction writers of the period who, up to date in every particular, always armed their heroes and their blackguards with automatics of remarkable properties rather than the usual workaday revolver. To these knaves of the pen we owe the popular idea that an automatic pistol is a small machine gun, whose trigger has only to be held back to discharge a stream of bullets, all of which hit the target.

Early automatics sometimes did this; the nose of the scear was soft or broken, but such is the recoil that if this disconcerting function of rapid fire occurs, all the contents of the magazine are fired in one swift roar and the weapon finishes pointing skyward. It is impossible to control. A separate trigger pressure for each shot is indispensable for every discharge if any modicum of lethal, let alone accurate, fire is to be desired.

The revolver, threatened by the popularity of the automatic pistol, endeavoured to adapt itself to the new fashion. Many plans were mooted, but the only models attaining any moderate usage were the Webley-Fosbery systems, which enjoyed a spell of life from 1896 to about 1912. In this the action in general was that of the Service Webley, but the cylinder was externally grooved in a manner similar to the old single action Mauser revolver of 1888, and recoiled together with the frame and barrel on slides attached to the butt. The recoil cocked the hammer and rotated the cylinder so as to present a fresh chamber. The fault of the arm was that it required to be fired with an inordinately rigid arm. The more expert and experienced the shooter the more easily flexed and less rigid his muscles, for the expert shot, so to speak, "catches" the recoil of his pistol as an expert cricketer catches a fast ball, not with a rigid outstretched arm, but with flexed recipient muscles. The Webley-Fosbery[1] was made in two calibres, ·455 and ·38, the latter supplied with cartridges in eight shot clips to drop into the chambers of the eight shot revolver.

This hybrid arm was high above the hand, and had many disadvantages, but it represented a system which has not even yet been fully developed. The chief source of jams in automatic pistols is the unsatisfactory nature of the feed. Cartridges are inserted in flimsy steel magazines held in the butt. Very slight deformation of the lips of the magazine (caused often in loading the cartridges) is sufficient to introduce a factor of error which no accuracy of machining in the moving parts of the action can overcome. The use of the revolving chamber was free from this objection, and it is probable that further clip loading revolvers will enjoy a period of use before the automatic pistol is able to supersede them.

Magazine or charger loading, such as is now almost universally employed, was not favoured in the earliest automatic arms, many of which were clip loaders, and was again abandoned by the latest military design produced

[1] 1900, Pat. No. 96.

before the war. In this the Steyr pistol of 1912–1914, a part rotating barrel was employed. This locked the breech during firing, and the breech and barrel so locked recoiled together for a short space before an interrupted quick twist stud on the barrel disengaged it from the recoil slide. The weapon was loaded by means of clips of cartridges inserted from above, and was of excellent design but for one failing : the grip or handle was almost at right angles to the barrel axis. This is a common fault with weapons designed on an engineer's drawing-board almost without reference to their needs as weapons.

Pistols like the Webley automatics, the Steyr and the early automatic Colts, were of little use as pistols, because this unnatural rectangular position of the butt meant that in action, when emotions run higher, the user discharged them without conscious aim, and the bullets struck the ground about ten yards in front of him. In a well-designed pistol the stock is set to the barrel in the usual angle of the natural grip of the hand, which is nearer to 145 degrees from the barrel axis than the 90 degrees of the draughtsmen designer. However excited the individual, the barrel axis is more or less in a parallel line with his index finger, and as in shooting he points instinctively, and points at whatever he is looking at, so in a modern pistol the stock is shaped to give him natural pointing effect and accuracy of fire is attained independent of conscious aiming. The majority of cheap blow back pocket weapons still ignore this essential, but post-war design shows an increasing acceptance of the fact by intelligent manufacturers.

Until 1903 all automatic pistols were small bore, usually 7·63 or 7·65 mm., and with 9 mm. representing a maximum limit. These cartridges, although giving a muzzle velocity far higher than that of the Service revolvers, lacked stopping power, the light small calibre projectile tending to traverse a body rather than develop all its energy and flatten out within the tissues. This inadequacy led to the rejection of the Luger-Parabellum 7·63 calibre military pistol, which was tried by the U.S. Government in 1903, and the issue of the Colt Firearms Co. of the first ·45 calibre automatic pistol other than the Webley-Fosbery.

This Colt ·45 superseded an experimental issue of a ·38 auto model of similar mechanical design but smaller bore. The principle used is that of the "parallel ruler," a hinged barrel is pressed by the face of the breech

block into a position where lugs on the top of the barrel engage with internal projections on the recoiling sleeve attached to the breech bolt which encloses both barrel and recoil gear. This original ·45 auto has a clumsy handle set square to the barrel, and was superseded in 1911 by the Colt ·45 Automatic Government model. This had an improved sloping handle, and was the weapon largely adopted by the U.S. forces in the Great War. The Canadian Expeditionary Force was also equipped with it, but their model was chambered to take the ·455 Webley self-loader cartridge. This was an error, as the Webley ·455 cartridge is inferior to the standard Colt U.S. Government. The Colt proved as good as any other automatic pistol on service, but was generally deemed far inferior in reliability to the revolver.

In the ·38 calibre the shape of the handle was not changed, and the arm though obsolete is still made in this model with only detail improvements on its original form as issued over twenty years ago. The Colt hammerless pocket models of ·380, ·32 (1903) and ·25 (1910) auto are simple blow back arms of no particular peculiarity but good workmanship. The ·22 auto target pistol of 1912 is provided with a sloping handle and is of more advanced design.

In 1905 the Webley self-loading ·455 pistol was adopted for the British Navy. Sea service involves but a tithe of the service conditions of dust, mud and dirt inseparable from land campaigning, but the same weapon when issued during the war for the use of the Naval Division on land was of little value. In this arm the barrel was provided with diagonal lugs, engaging with recesses cut in the frame in such a manner that the barrel pressed forward by the breech block locked a lug in its upper surface with a recess in the recoil slide. A complex safety grip and an external hammer provided additional factors of complexity. In all the large Webleys the recoil spring is housed under the light cover of the right-hand stock plate, a slender piece of vulcanite. In addition the stock is almost square to the barrel axis. They suffer from this bad design and are not robust enough for service usage. As police arms they attained a certain sale, but the modern tendency is clearly shown in the arming of both civil and military police forces with a reliable revolver in place of any form of automatic pistol. Webley pistols were made in wide range of locked breech models for the ·38 Colt, ·455 Webley and 9 mm. Long auto. In

the latter models some were hammerless. The blow back pocket pistols cover ·380, ·32 and ·25 auto in hammer and hammerless models. They present the same faults in design and shape as the larger models.

The original Mauser locked breech model was not modified except in calibre and immaterial details after its first appearance on the market. In 1914 the calibre was changed from 7·63 to 9 mm. in order to take the German service pistol cartridge as used in the Luger-Parabellum. The Mauser Company produced a ·25 blow back pocket model hammerless in 1911, and in 1915 a larger version of this designed to take the ·32 auto pocket pistol cartridge. It was largely used as a supplementary weapon by German troops in the war, but was far too weak for serious service use.

If we examine the automatic pistol systems used in the war, we find among Service arms with locked breech action only the Colt, Webley, Luger, Mauser and Steyr (Mannlicher) systems. A great number of blow back action pistols were used, but these fired no cartridges of higher energy than the relatively feeble ·380 auto and most were only calibered for the ·32 auto. Before passing to these there is one arm with a semi-locked breech action, the Savage, U.S.A. (1903). This weapon is very well made and has a large capacity magazine holding ten shots. The barrel is free to revolve and is provided with a lug engaging with a short section of quick thread screw on the recoil sleeve. This functions as a detaining action, and the arm can be made lighter than would be necessary with a purely blow back breech. It is only, however, made in the ·380 and ·32 auto sizes. The Remington U.M.C. ·380 pistol of 1918 is also well designed, but not as good as the Savage.

In 1919 the application of the delay or detaining action was ingeniously employed in an arm known as the Thompson sub-machine gun. This was an automatic carbine firing pistol ammunition and was developed in the U.S.A. about the same time as the German Bergmann *muskête* was used in the European war. The latter was an auto carbine with a blow back breech and air cooling devices which fired German Service 9 mm. pistol cartridges and was of great value as a supplementary weapon in the close range conditions of trench warfare.

The Thompson gun based its claims on a new principle. A saddle-shaped member with inclined planes was interposed as a lock between the

breech and the barrel. In theory this jammed tight, or adhered under pressure, and the breech was locked until the projectile had left the muzzle; on the relief of the pressure a secondary effect came into play and under the slighter pressure the locking bolt lifted and allowed the action to work. Experts are sceptical about this claim, and the gun works just as well with the locking device removed. The weapon was introduced into England and was being considered by the authorities when it was discovered that many had been sold to the Irish rebels, and a ship loaded with Thompson guns, meant for use against the British, was stopped in New York harbour before sailing. Additional piquancy was added to this situation by the discovery that the Vice-President of the Automatic Ordnance Corporation, who owned the arms, was related to the U.S. Ambassador to Great Britain at the time. Their British patent rights were later acquired by the Birmingham Small Arms Co., but the arm has not so far become popular.

In general any slight delay action suffices to strengthen the initial resistance of a blow back system sufficiently for it to be used with far more powerful cartridges than are generally considered applicable, and modern design has evolved several systems.

The great mass of contemporary pocket pistols on the blow back system present only differences of detail. In some the recoil spring is placed round the barrel as in the 1914 model Browning F.N. In others it is below, as in the Colt and Mannlicher models. Others house it above as in the Bayard and Dreyse.[1]

The following list covers most of the makes marketed from 1900 to date, but is not necessarily complete:

U.S.A.

Colt, ·45, ·38, ·380, ·32, ·25, ·22.
Harrington and Richardson, ·380, ·32, ·25.
Savage, ·380, ·32.
Reisling, ·22.
Remington, U.M.C., ·380.
Smith and Wesson, ·35 special (a failure, now no longer made).
Hammond experimental, ·45.

[1] For reference to detail see Pollard, *Automatic Pistols*, Pitman, 1919.

Belgium

F.N. (Browning), ·9 mm., ·380, ·32, ·25.
Bayard, ·380, ·32, ·25 and special cartridges.
Clement, ·380, ·32, ·25.
Pieper, ·380, ·32, ·25.
Jeffico, ·380, ·32, ·25.
Warnant, ·32, ·25.
Melior, ·32, ·25.
Delu, ·32, ·25.
Le Rapide, ·32, ·25.

Central Europe

Steyr, 9 mm., 7.65, .32, ·25.
Frommer, 9 mm., 7·65, ·32, ·25.
Roth, 9 mm., 7·65, ·32, ·25.

France

Le Francais, ·25.
Meteore, ·25.
Monobloe, ·32, ·25.
Claire, ·35 (French revolver cartridge).
Fiel, ·25.

Great Britain

Webley-Scott, ·455, 9 mm., ·38, ·380, · 32, ·25, ·22.
Webley-Fosbery, ·455, ·380.
Mars, experimental.
Gabbett Fairfax, experimental.
Pollard, experimental.
B.S.A., experimental.

Germany

Schwarlose, ·32 and special cartridges in early models.
Mauser, ·9 mm., 7·65, ·32, ·25, 7·63 mm.
Luger-Parabellum, 9 mm., 7·63 mm.,
Walther, ·32, ·25.
Schmeisser, ·32, ·25.
Mann, ·25.

Venus, ·380, ·32, ·25.
Dreyse, ·380, ·32, ·25.
Bergmann, special cartridges.
Roth-Sauer, ·32 and special cartridges.
Stock, ·32, ·25.
Stenda, ·32, ·25.
Ortgies, ·32, ·25.

Spain

Star, 9 mm., ·380, ·32, ·25.
Victoria, ·32, ·25.
Stosel, ·25.
Destroyer, ·32, ·25.
Ruby, ·25.
Astra, ·380, ·32, ·25.
Eles, ·25.
U.A.E., ·32, ·25.
Walman, ·32, ·25.
Kappora, ·25.
Vincitor, ·32, ·25.
Royal, ·25.
Imperial, ·25.
Pinkerton, ·32, ·25.
Frontier, ·25.
Royal Extra, ·25.
Sprinter, ·25.

Note.—Spanish names are applied more as selling titles than as distinctive names. Most of the arms are extremely inferior in material and craftsmanship. They are very cheap and sold all over the world.

Italy

Glissenti, ·380, ·32.
Beretta, 9 mm. (Luger), ·380, ·32, ·25.

The automatic principle has been applied to sporting shotguns in the Browning, Winchester and Remington arms previously described, and also to a European gun, the Sjögren (now obsolete).

Certain experimental rifles, which represent attempts to achieve a military automatic rifle, may be met with. These represent little more than experimental weapons used for tests and never adopted. One of the earliest of these is an attempt to convert the ordinary straight pull Mannlicher rifle of 1895 to automatic, by attaching a gas piston below the barrel and allowing a lever to operate the ordinary bolt. A similar device was even earlier applied by Krnka to the Werndll service rifle. A later arm is the Mondragon, but this is only semi-automatic and meant for rapid fire at close quarters. Individual arms of this nature can usually be identified by search of the patent files. A great many freak pieces of little interest and no collectors value were made during the war. Every nation had its experimenters who submitted odd models to the War and Inventions departments.

CHAPTER XI

MODERN MILITARY RIFLES IN THE GREAT WAR

THE modern military small bore magazine rifle has been much improved since its adoption some twenty years ago. The changes have been in detail rather than in any important change of principle, and represent the result of years of experiment and research applied to particular problems. Modern science has found out far more about the bullet's flight and conditions governing small arm precision than was formerly known. The modern soldier is officially accepted as having a better and more educable brain than his gallant predecessors, and tactical experience of fire tactics gained in modern warfare in all quarters of the globe has been considered.

Theory is not, however, everything. In theory the Mauser rifle was undeniably superior to the short Lee-Enfield, in practice the latter was a far better weapon for service use. Experts knew that the Mauser system furnished a better and more symmetrical bolt action, capable of firing cartridges which would give higher velocities and flatter trajectories. In practice the Lee-Enfield, with its greater magazine capacity and far more easily operated bolt, its reliable extraction and its freedom from jams, proved a far better weapon. In the early days of the war, when field actions were still being fought, the Lee-Enfield used by trained soldiers utterly outclassed the Mauser. It was almost equivalent to a machine gun.

The main differences between the early small bore magazine rifles and the later improved types may be classified in order of importance as, firstly, the universal change to charger or clip loading of the magazine. Secondly, the adoption of a pointed bullet, in some cases "boat tailed" or tapering to the rear. These new projectiles superseded the old round nosed types between 1905 and 1912. Thirdly, the adoption of a light double trigger pull so that a relatively long travel of the trigger is divided into two

portions, the first overcoming the resistance of a weak spring; the second leverage being quick acting and clearing the scear from bent, is perhaps the next greatest step. This affords an easier and speedier trigger pull, yet still carries the old margin of safety. Fourthly, great attention is now paid to devices intended to eliminate flip or jump, a phenomenon due to a natural vibration of the barrel under the shock of discharge.

Details of improvement in extractor mechanism, sighting and protection of the barrel have been applied to most standard service arms.

The collector of the future will find a baffling complexity of models varying very slightly in detail. These are not important to our purpose of presenting a general history of all types of firearms, and they can be found by the specialist student detailed in the official *Text Book of Small Arms*,[1] and kindred official publications of other nations.

The complexity is further advanced by the enormous number of conversions by which existing arms were remodelled or renovated. As an index to our own British service rifles the following guide may be of use:

Long Rifles ·303 magazine.

Lee-Metford	Mark	I	1898
,,	,,	,,	I* (star)	1892
,,	,,	,,	II	1894
,,	,,	,,	II*	1895
Lee-Enfield		,,	I	1896
,,	,,	,,	I*	1899

Of these Lee-Enfields many were converted to charger loaders for the use of the Territorial Force in 1908.

Short Rifles ·303 magazine charger loading.

Lee-Enfield	Mark		I	1904
,,	,,	,,	I*	1907
,,	,,	,,	I*** (three star)	1914 for pointed bullet Mark VI cartridge.
,,	,,	,,	III	1907
,,	,,	,,	III*	1916

[1] A new issue of the War Office *Text Book of Small Arms* will be issued shortly.

Many long rifles were shortened or rebarrelled, and converted to short rifles, and later all in use were resighted to take the Mark VI pointed bullet cartridge.

In addition to the standard short Lee-Enfield of 1904, which is still the official rifle of the British services, there is a model known as the 1914 pattern Enfield ·303, which was largely manufactured, but never used in war. This was a new rifle, since adopted as a Springfield model by the U.S. It was designed some years before the war for the ·256 small calibre cartridge and was officially accepted as the next weapon to be made and issued. It was then remodelled to take the new improved ·303 cartridge with the pointed bullet, which is preferable to the ·256 as having a greater shocking power.

The 1914 rifle weighed 9 lbs. 6 ozs., had a length of 3 ft. 10¼ ins., a magazine capacity of 5 shots and a muzzle velocity of 2·380 f.s. It embodied an aperture or "battle sight" and was somewhat similar to an improved Mauser.

The arm was easier and cheaper to manufacture than the short rifle. During the war some 300,000 were made in the U.S.A. by Remington, Westinghouse and other firms, but the standard of production was low. The parts of rifles made by different manufacturers are not interchangeable and the arms so made were never issued, but retained as an inferior reserve for national use in emergency.

The latest model British service rifle weighs a pound less than the old short Lee-Enfield, embodies an aperture or battle sight, and the bayonet is to be reduced to the lowest possible form of encumbrance. It has not yet been issued and is still undergoing tests.

The Continental nations still make use of both rifles and carbines, but in the British Empire the short rifle was adopted in 1904 for all services and represents an arm short enough for cavalry use and long enough for the infantryman. Experience during the Boer War proved that the carbine was both short ranged and inaccurate. It became increasingly evident that the rôle of cavalry was that of mounted infantry, and the conclusions so reached were abundantly justified in the European War, when cavalry were in emergency used to reinforce infantry in trench warfare. On the Continent a very wide range of barrel lengths were in use before the war. Special short rifles or long carbines were made for

the artillery, other variations for mountain troops, gendarmeries and special branches. In most cases these were simply modifications of the ordinary rifle without any change in system. An exception is the French Lebel carbine, which in place of having the tubular magazine of the rifle has a shallow box magazine for three cartridges.

The state of world armament at the outbreak of war was as per attached schedule:

TABLE OF ARMAMENT, 1914

Great Britain .	Lee-Enfield	·303	Short rifle.
Canada . .	Ross	·303	(Rejected on service.)
U.S. . . .	Springfield	·300	Model '03.
	Springfield	·300	Model 1914.
Argentine . .	Mauser	7 mm.	
Austria-Hungary .	Mannlicher	·315	Model 1895.
Belgium . .	Mauser	7·65 mm.	
Bolivia . .	Mauser		Model 1898.
Brazil . . .	Mauser	various	
Bulgaria . .	Mannlicher	·315	
Chile . . .	Mauser	7 mm.	Model 1895.
Denmark . .	Krag Jorgensen	8 mm.	
	Remington	8 mm.	Carbines.
Ecuador . .	Mauser	7 mm.	
France . .	Lebel	·315	
Germany . .	Mauser	·311	Model 1898.
Greece . .	Mannlicher-Schönauer	6·5 mm.	Model 1903.
Guatemala . .	Mauser, Remington		Obsolete weapons.
Italy . . .	Mannlicher-Carcano	6·5 mm.	
Japan . . .	Arisaka-Mauser	·256	
Mexico . .	Mauser	7 mm.	Model 1901.
	Remington	7 mm.	Model 1893.
Montenegro . .	Russian 3 Line	·299	Model 1898.
Nepal . . .	Martini-Henry	·450/577	
Netherlands . .	Mannlicher	6·5 mm.	Model 1895.
Norway . .	Krag Jorgensen	6·5 mm.	
Paraguay . .	Mausers and mixed		

Persia . . .	Mauser and mixed		
Peru . . .	Mauser		Model 1891.
Portugal . .	Mauser, Verguiero	6·5 mm.	
Rumania . .	Mannlicher	·256	
Russia . . .	3 Line	·299	Model 1891.
Serbia . . .	Mauser	7 mm.	Model 1899.
Siam . . .	Lee-Enfield	·303	
Spain . . .	Mauser	·275	Model 1893.
Sweden . .	Mauser	6·5 mm.	
	Remington	6·5 mm.	
Switzerland . .	Schmidt Rubin		Model 1893.
Turkey . .	Mauser	7·65	Model 1890.
Uruguay . .	Mauser and mixed.		
Venezuela . .	Mauser and mixed.		

Taking the Powers one by one it may be said that they brought in not only their existing models, but all obsolete ones as well. These were used nominally for reserve troops, but all too soon all reserves everywhere were needed in the field.

The Austrians brought not only the 1895 pattern Mannlicher straight pull, but the modified Mannlicher-Schönauer with the revolving magazine popular in sporting rifles. These were available in quantities at Steyr, and manufacture was proceeded with during the war. In addition they used the old 1886 Mannlicher of 11 mm. and the 1890 model of 8 mm. for reserve troops.

The same 8 mm. rifle with detail differences was also in service for Greece and Bulgaria.

Belgium entered the war with Mausers of the 1889 pattern of 7·65 calibre, but was rearmed with French Lebels when a continuous front was established late in 1914. Turkey had mainly 7·65 mm. Mausers of 1890 pattern at the beginning, but was rapidly rearmed by the Germans with 1898 model German Mausers of 7·9 calibre, the standard German service rifle and cartridge. Reserves had ·45 calibre Remingtons and many old black powder rifles, such as 1880 Peabody-Martinis of ·45 cal.

France was still armed with the 8 mm. Lebel of 1886 pattern, but modified in 1905 to take a pointed bullet. Her reserves still carried the

Gras model of 1874, a ·43 calibre black powder arm, and in some cases the Kropatschek of 1878, a tube repeater taking the same cartridge. The carbine was the Lebel model 1890.

Great Britain used the short Lee-Enfield model 1904, and obsolete types were retained for home training. The only exceptions were the Naval Division at Antwerp, who were hastily armed with old model long Lee Enfields, and the first Territorial troops to reach France, who brought with them their charger loading long Lee-Enfields. All were of ·303 calibre and had 10 shot magazines fed with two clips of five rimmed cartridges. In order to establish uniformity, all models other than the short Lee-Enfield were withdrawn and returned for training purposes. The Canadian forces arrived armed with the Ross rifle, which had been adopted as the official arm of the Dominion, because it was Canadian rather than because it was good. After some bitter experience the Canadians threw away their Ross rifles and rearmed themselves with sounder weapons from the British dead. Remonstrances from Headquarters and even Canadian financial and political circles failed to check this practice, and in the end the Canadians were allowed to have the reliable Lee-Enfield in place of the Ross. The Ross breech bolt had two failings. It jammed in mud and it often blew back and shot a man's eye out. The Lee-Enfield, on the other hand, seems to work anywhere, from Archangel to the Equator, and under all and every kind of Service condition.

The Russians used their own rifle, the 3 Line of 1900, a bolt action box magazine rifle of ·3 calibre. It always carried an old-fashioned X sectioned bayonet, and no scabbards were supplied for these which were a permanency on the rifle. This is not good for precision, though in point of fact the rifle itself is well designed and accurate. Vast numbers of these rifles were made for Russia in the U.S.A., but were not delivered owing to the revolution. It is understood that they have since been sold again and have now reached Russia.

In general it may be said that the Allies used rimmed cartridges. The British ·303, the French Lebel, the Russian 3 Line, the Roumanian Mannlicher all took rimmed cartridges. The Mauser of all types and nations fired the rimless type and suffered from difficulties of loading and extraction under adverse Service conditions. The Lee-Enfield was the

shortest rifle. It had a 25 in. barrel as compared to the Mauser 29 in., but this was a decided advantage for trench use as well as open warfare. Its signal advantage was, however, the cranked bolt handle, which allows it to be used very much more speedily than either Mauser or Mannlicher.

Since the war, while no great issue of fresh armament has taken place, certain changes have occurred. The Serbian Mauser, the Belgian Mauser and the Portuguese Mauser were replaced during the war by one or other of the allied weapons in order to simplify ammunitioning. At present Serbia has about five kinds of obsolete rifle. The newly created nations retained their armament if they simply changed sides or withdrew, like the Czechs, who retain the Mannlicher. Poland, on the other hand, was rearmed with a lot of obsolete Lebel rifles by the French. Latvia has mainly ·303 and a reserve of 7·9 German Mausers. Lithuania has 7·9 Mausers, ex-German war stock, and there has been a general redistribution of existing stocks rather than a proper rearmament.

In practice, it may be taken that a representative collection of the small arms used in the Great War begin with match locks used by Persian raiders or in Africa, flint locks, percussion muzzle loading, and then through black powder obsolete rifles used by native troops and reserves, reaches to modern arms. There are, in addition, all the worthless experimental and inventors' models, extemporised grenade projectors, and crude conversions of rifles to rough machine guns and what not.

It is doubtful if an attempt to collect all types of arms used could succeed; it is certain that such a collection would be in the main valueless. The normal types are adequately recorded in the War Office *Text Book of Small Arms*, a new edition of which is now in the press. The variants are mostly recorded in the archives of the Munitions Designs and Small Arms Committees, but are not available for public reference. A proportion of important arms are on view at the National War Museum, South Kensington.

If we consider the lessons of the Great War in so far as small arms are concerned, we find that European conditions and warfare of position made little demand on the long range capacity of the rifle. The aspect of range so essential in the Boer War of 1898–1900 was negligible. Little shooting was done at ranges exceeding six hundred yards by any combatants.

The essentials are speed of fire, ability to withstand mud or sand without rusting up or jamming; a flat trajectory so that sighting is automatic rather than left to the private soldier, penetrative capacity adequate to render ordinary sandbag cover inadequate and body armour useless.

The ammunition, no less than the rifle, must also be studied from the point of view of resistance to Service conditions. Non-rusting clips and similar loading facilities are important. In gas warfare the corrosion resisting qualities of small arms may be severely taxed.

It is worthy of note that the war began with simple small arm ammunition. Very soon the explosive bullet made its appearance, nominally as a range-indicating device used by the Austrians. It was followed by incendiary bullets for use against aircraft, by armour piercing bullets for use against trench shields for snipers, and by tracer bullets for aeroplane duels. Other special ammunition to increase the effective zone of machine gun fire was in process of manufacture when the war ceased, and the last phases of the war showed a marked inclination on the part of all combatants to use machine-pistols, i.e. light weight automatic carbines using pistol ammunition for normal close range work.

There is a limit to the weight an infantryman can carry. Modern warfare involves the use of anti-gas protection devices, and it is probable that the weight of the rifle will be reduced[1] and the weight of ammunition with it in order to afford a counterpoise. The modern military bullet is of the high velocity boat tailed type, and it is possible that tracer bullets may yet be developed as an infantryman's weapon, for they are the best sighting device yet found.

The efficient automatic rifle has yet to be evolved; all those that are efficient are too heavy for reasonable use, but there is reason to hope that this difficulty will be overcome with the gradual evolution of a higher degree of efficiency in a smaller capacity cartridge. So far no nation has evolved anything which showed improvement on the light machine guns like the Lewis and other various types used in the war. Such experimental automatic rifles as the Chauchard and similar types were of little value in the field. In the same way the experiments designed to utilise some of the energy of the engine of an aeroplane as a propellant

[1] The latest British rifle is at least 1 lb. lighter than the standard model.

for projectiles without a powder charge were interesting but ineffective. The conditions of aeroplane combat mean close range, and it was thought that adequate energy could be found for a small arm of this peculiar nature. The results were disappointing to the air folk, but not unanticipated by small arm experts.

And so the chapter closes. We have surveyed, however scantily, the field of five hundred years of progressive design in hand firearms. Those who write fantasies of the future speak of death rays and other odd lethal forms which will supersede the firearm. Perhaps they are right, though I confess that I can find no gap in the known range of radiations where this death ray can still hide. Still, even in our own time we have seen the spread of restrictive legislation and the tendency to limit the sale of arms. It has ruined a certain amount of trade, but our criminal statistics show no difference at all. No measure of disarmament in history has ever been successful, for, after all, a club from the hedge or a hatchet is no less lethal than a gun in the hands of a criminal. Yet many types of firearm are so rapidly going into obscurity, that one may be forgiven for wondering if a reader of this book, a century hence, will be able to find any arm of *his* period to his hand than his service rifle, whatever it may be, and possibly a modified shotgun. I doubt whether a properly run world will tolerate pistols at any price. Still, who knows? They may be more popular and more necessary than ever, for there is nothing whatever in the history of firearms which leads one to believe that the need for them will cease until something more effective for their purpose is invented, and the song of the bullet is as distant an echo as the song of the sword to-day.

NOTES FOR COLLECTORS

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NOTES FOR COLLECTORS

CONDITION is perhaps the most important factor from the collector's point of view. Condition covers a variety of factors and may be said to vary inversely with age. A not very rare 19th-century piece needs to be in perfect condition if any value is to attach to it; a 17th-century piece may be very much more battered and yet possess value. It is unreasonable to expect a piece to have lasted a hundred years or longer without wear and tear, and perfection of condition in an early piece is in itself matter for suspicion.

A firearm or a pistol is a complex article to forge whole-heartedly, but as soon as the market value of pieces reaches a point where it is worth the while of a clever craftsman to fake pieces, forgeries occur.

Early wheel locks, Scotch pistols, and other arms with a value of over thirty pounds are liable to be forged. Usually the dealer does not do this to the extent of producing an entirely new weapon, but is content with fitting a genuine wheel lock to a faked barrel and a modern replica butt.

Barrels are often cut down from other pieces, plain stocks are decorated and inlaid "after the antique," and only an expert can determine the genuineness of the piece. The unwary collector may buy it from a West-End dealer for a three-figure value, and when he or his executors sell it will bring a mere ten-pound note.

No book-learning will guide the collector in this matter, but no reputable dealer will demur to selling a piece subject to approval. During the approval period it should be sent to an expert, who will give an opinion for a modest fee. Reluctance on the part of the dealer or the presence of mythical competitors for the possession of the piece may be taken at face value. Expert examination is in itself no easy task. Pieces may have been legitimately repaired or renewed during their history, hammers, for instance, have often been replaced, details of ram rod guides may have been mended, but on the other hand an apparently sound piece "in

working order" may be a manifest fake. There are a number of wheel lock arms about which have faked barrels and faked stocks. Sometimes the locks and barrels are original, but the stocks have been recently inlaid. A grotesque imposition is the carving of cherubs' heads and kindred applied ornament *into* the flat steel of plain locks. Where ornament of this nature is found it should be in *relief*, not set in, so that the level of the salient points is that of the plane surfaces. A variation of this trick has been welding lumps of metal to the plain lock plate and carving them later. Microscopic examination will disclose this.

Austrian and German fakers have devoted a good deal of careful thought to faking old arms, and many English dealers are unable (as well as unwilling) to distinguish between the genuine article and the very able forgery. The spurious decoration of plain old arms is one of the minor Continental arts.

Scotch pistols, because of their high price, afford a good market for the forger. Moorish snaphaunce locks, adequately treated, may be fitted to a gun-metal barrel and the proper type of early Scotch wooden or inlaid butt. 18th-century all-steel pistols may be redecorated with silver inlay, re-blued and "named." Percussions may be re-modelled to flint lock.

So good are some of these forgeries that a critical microscopic survey is needed to detect them. Among instances which have come under my notice are wheel lock pistols of all-steel Gothic type with barrels made out of cut down Indian guns; plain steel pieces carved, etched or sand blasted with spurious decoration; plain trooper's pistols inlaid with bone, etc., engraved to a period; percussion arms re-converted to flint; spurious lock fitting and the engraving of valuable names or bogus dates on inferior weapons.

In general it may be said that on any arm costing over twenty-five pounds an expert's opinion, at a cost of a guinea, is a sound investment. Good arms will increase in value, but dubious or faked pieces are worthless.

In guns it is important to note that the cock or hammer is original. Often it has been replaced with a later type. Duelling pistols are always in pairs and in cases, but holster pistols, pocket pistols and military arms were usually sold without the case. True duelling pistols, excepting the early and rare ball butted Irish type, never exceed half an inch in bore and

are long barrelled. A good set is worth from five guineas upwards. Pairs by leading makers may run to ten pounds for Egg, or twenty-five guineas for Joe Manton. Blunderbusses are getting increasingly rare, and a good specimen with brass barrel is worth at least five pounds. Those with folding bayonets are rather more valuable, and the type with the detachable bayonet is the rarest of all.

All multi-barrel pistols are worth having, and any curious variation from normal type is of distinct value. Percussion arms, which are now to be picked up at relatively low prices, are increasing in value. The percussion period only lasted some fifty years, as against the two hundred and fifty years of flint locks, and arms of this period will become increasingly rare. Perfect pairs of French ebony and chased steel duelling pistols, with equipment, may fetch from fifteen guineas.

Early breech loading arms are now coming within the purview of the collector. Flint lock breech loaders are extremely valuable, but early paper cartridge guns have not yet been seriously taken up. As the period of these covered barely a decade they are certain to rise in value.

Certain early arms of American manufacture are worth their weight in gold—but they are few, and considerable knowledge is necessary before they can be appraised. The first Colt and some special flint lock pistols are extremely valuable. Military arms made in quantity are relatively worthless, though they appeal to a few collectors who specialise in low priced specimens of crude workmanship.

Arms prior to 1800 are ascending in value. They have risen to three times their former price in a decade. Arms prior to 1750 have risen even higher, and 17th century arms, a general term which includes the so-called Queen Anne walnut butted cannon barrel pistols are becoming extremely scarce and valuable. Ten years ago three or four guineas would purchase a good pair of Queen Anne type pistols. To-day they fetch ten guineas or more at auction.

Modern and quasi-modern arms present a rich field for the collector. They are at present outside the antique dealers' field, but early specimens of the 'sixties are, owing to the pressure of American and Continental collectors, becoming harder to find. In general, it may be said that all types of small arm, with the exception of military and common factory models of wide dispersion, are a sound investment and represent a

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permanently rising market. Pistols are preferable to guns because they are easier to display and occupy far less space; a gun collection soon needs an armoury. A type collection takes a long time to get together for antiques cannot, like current goods, be purchased at any given moment.

If you doubt this, try to acquire for yourself a representative little collection, beginning with the easiest pieces, as follows :—

One pair percussion pocket pistols.
One pair flint box lock pistols (late).
One pair flint carriage pistols (late).
One pair percussion military or holster pistols.
One pair percussion duelling pistols.
One pair percussion saw-handled duelling pistols.
One pair percussion flint duelling pistols.
One pair percussion flint carriage or holster pistols.
One pair percussion military carriage or holster pistols.
One pair percussion 1750 pistols.
One pair percussion " Queen Anne " ball butt.
One pair percussion semi side lock cannon barrels.
One percussion " Charles I " wheel lock pistol.
One Scotch pistol.
One percussion snaphaunce.
One 16th-century wheel lock pistol.

This simple representative schedule could be expanded to include a hundred variant pieces, such as coach pistols, blunderbuss pistols, long dragoons, preventive arms, box locks, all-steels, and other types.

In guns and rifles an even more difficult field will be encountered. Poor specimens are easy to find—and incidentally should be acquired until they can be replaced by better pieces. This is one of the economic secrets of collecting. Buy a poor piece at a low price and hold it until you find a better one, for it may be years before the opportunity occurs. In the meantime the poor piece will have risen in value and your own knowledge increased. Sell poor duplicates, either by advertising in *The Exchange and Mart* or by auction at Stevens' Sale Rooms.

The collector will need to master the art of putting disordered or ill-kept arms in repair or condition. The first essential is not one screw-

driver but several of different widths, and these of the fine quality used by clockmakers, which will keep and hold a fine narrow edge. A brace and bit with a screwdriver edge will serve to turn stiff and obstinate screws where a screwdriver fails. A rusted lock should be soaked for a week in paraffin oil before dissembling is attempted. After soaking, the oil should be driven off on a hot plate, such as the top of a stove, and when scoured of rust the whole should be assembled with a liberal supply of Rangoon gun oil.

Springs are dealt with by a mainspring cramp to be bought of any gunsmith. Pins, which are used in place of screws in early locks, need to be dealt with with a set of finely tempered thin punches which cannot be bought ready-made, but can be made by an intelligent blacksmith or artificer.

Browning or blueing is a difficult art for the amateur and is better and more cheaply done by a really good gunsmith. Mr. Robert Churchill of Leicester Square has workmen who can be depended on not to spoil an old piece, but country gunsmiths and odd workers are best avoided.

Deep rust can be removed by expert treatment, but the process is leisurely and rather expensive. It leaves a bright surface and does not attack the metal. Electrolytic cleaning is to be deprecated as it involves a violent use of the scratch brush and spoils the weapon.

Polish varies with the steel. Some Spanish pieces of extremely pure material take and hold a perfect polish with rouge and crocus on a buff. This treatment is often too severe for English pieces, whose metal is better re-blued orre-browned. Nothing will take out deep rust pitting. Avoid emery in any form.

Woodwork needs dressing with boiled linseed oil compounds and adequate elbow-grease. Walnut oil is the best natural polish for walnut stocks.

Many first-class pieces have stocks which have been polished with shellac compounds, or the rarer varnishes of the *vernis Martin* type. These should be stripped of metalwork and touched with tepid water to remove dents and then repolished by a skilled worker.

Damascened and inlaid pieces cannot be repaired or reconditioned except under special conditions and at very high prices. In general, it is far better to replace a missing piece with a piece of new material which

makes no attempt to imitate the old except in shape and outline. A repair or replacement is always a repair, and it is better policy and better in every way to leave the replacement unmistakably as such than to attempt a replica which might be misleading to a novice. An imperfection or a piece missing is always preferable to an artfully faked dealer's forgery.

Original condition, even if faded and blemished, is always preferable to a highly emeried and sand-papered piece from a dealer's shop. He likes a nice shiny weapon fit for a trophy on the wall—but the original weapon was probably blued or russetted. All-steel pistols, and possibly Queen Anne cannon barrels, were perhaps the only arms sold "bright," or "white." All fowling pieces, rifles, etc., should of necessity be coloured down. Brass barrels are of course bright, and are best scoured with mild household ammonia and then polished with whitening.

Prices are a very variable factor, dependent on condition, rarity and demand. Sale prices give some index, but it should be remembered that lots may be "bought in" against a reserve or go for a low price to be cut up by the ring of dealers later.

Among recent sale prices recorded, I find the following :—

	£	s.	d.
Double barrel flint lock sporting gun by Tow	9	5	0
Italian single flint lock gun (17th century)	17	10	0
Pair of brass three barrel tap action pistols (18th century)	16	0	0
Pair of late cannon barrel pistols, silver marks inlaid silver wire	17	0	0
Double barrel under and over cannon barrel pistol	11	0	0
Double barrel flint lock gun by Tow	10	10	0
Pair of flint lock pistols with silver marks	9	10	0
Pair of ditto by Delaney	10	0	0
Pair of early steel mounted cannon barrel pistols	17	0	0
Holster pistol inlaid gold on steel	14	0	0
Holster pistol carved brass mounts	15	0	0
19th-century flint lock pistol (late Spanish)	5	0	0
Four barrel brass pistol	15	0	0
Blunderbuss pistol, brass (19th century)	4	10	0
Small all-steel pistol	5	0	0
Pair small all-steel pistols	13	0	0

	£	s.	d.
Double barrel all-steel pistol	13	10	0
Four barrel ditto	27	0	0
Pair Spanish ball butt brass mounted pistols	18	10	0
Pair Lazarino Comminazzo flint lock pistols, finely chiselled mounts	100	0	0
Pair Italian wheel lock pistols, chiselled steel mounts .	90	0	0
German wheel lock dag with ball pommel . . .	38	0	0
Single pistol by Lazarino Comminazzo	42	0	0
Inlaid European matchlock musket.	40	0	0
Snaphaunce sporting gun by Lazarino Comminazzo .	170	0	0
Wheel lock with reiter pistol ball butt	40	0	0
Pair ram's-horn Highland pistols, Murdoch Doune . .	72	0	0
Snaphaunce pistol, Italian, plain	16	16	0
Single Highland pistol, Murdoch Doune	38	0	0
Pair of Highland pistols, ram's-horn butts, by "Alex Campbell"	65	0	0
Single Highland pistols of late type (average price) . .	12	12	0

These contemporary prices may serve as some index to the really good pieces, but it cannot be too strongly noted that pieces from a known collection are more valuable than equivalent casual acquisitions, and that condition is a vital factor.

APPENDIX I

COLT ARMS

COLT muzzle loading revolvers fall into three broad groups. First, the rare early 1836–1842 arms, made at the Paterson factory, generally called "Texas pistols." These are rare and valuable, and can be distinguished by the address on the barrel being Paterson, N.Y., by the absence of a loading lever and by the fact that the trigger is a folding member hinged to the lower forward extremity of the frame. No trigger guard is incorporated; weight 2 lbs. 7 ozs.; calibre ·34.

When in the original case the pistol is accompanied by a special loading tool, a combined powder and bullet flask for simultaneous loading of all the cylinders, and a disc-shaped cap magazine with a spiral spring feed. This bears the familiar rampant horse trade mark associated with Colt.

These pistols were hand finished and were not mechanically standardised. Calibre ·28, ·31, ·36, ·40, ·44 and ·50 are known. They were made from 1836 to 1842. Details are shown in patent, December 8, 1835.

In addition to the folding trigger model a heavier weapon, known as the "Walker model" fitted with a loading lever and a trigger guard, was designed in 1839 to meet the needs of the Texas Rangers. It bears the Paterson address, but is otherwise similar to the revolvers of the next group, those made under contract at various shops, but sold from Colt's office in New York, and marked "Address Saml. Colt, New York City." The calibre is ·44, the weight 4 lbs. A ·47 calibre was also made.

This second group begins with the 1847 Holster or Army pistol model of 1847. These are ·44 calibre and weighs over 4 lbs. They are variously known as Dragoon Colts or Holster Pistols. U.S.M.R. (United States Mounted Rifles), U.S.N. (United States Navy), U.S.M.I. (United States Mounted Infantry) are letters indicating the branch of the service to which they were supplied. The 1847 model bears the date on the barrel lug and is rare. The ·48 model is undated and was made with few material

alterations till 1860. Finish varies. Those later than 1851 have safety pins on the bosses between the nipples and a slot in the lower face of the nose of the hammer. Extension stocks with canteens, etc., inside were fitted to some models.

The Pocket pistol, 1848, is ·31 calibre and marked "Address Sam'l Colt, New York City," and had no ramming device. This was superseded in 1849 by the usual pocket Colt with rammer, marked "Address Col. Sam'l Colt, New York, U.S. America," made in ·31 and ·34 calibres. There are wide variations in barrel length. Some cylinders are fluted, some plain. The engraving represents highwaymen attacking a carriage.

Intermediate between the Holster and the Pocket types is the ·36 Navy Colt or Belt pistol of 1851, weight 2 lbs. 10 ozs. This is perhaps one of the commonest of the Colts and is always of ·36 calibre. The engraving shows a sea battle, the engagement between a Texas steam vessel, the *Mississippi*, and a Mexican ship, which took place in 1843.

These three models are the only ones of which London made examples exist. Of these the Navy Colt of ·36 calibre is the commonest. English variants show a model with the fluted cylinder.

The London Pocket Colts show several minor varieties. The calibres embrace ·31, ·33, ·36, and the only rare variety is the Pocket Colt of ·36 calibre with the rear of the cylinder turned of smaller diameter than the front. The large Dragoon Colts were finished rather than made at the Pimlico factory, and few were made bearing the English stamp "Address Col. Colt, London," or "Address Saml. Colt, London," which appears on the Navy and Pocket models of British provenance. Such Dragoon Colts which I have seen with a London legend on the barrel have it *engraved*, not stamped. The Colt Dragoons sold in England can be identified by British proof marks on barrel and chamber.

A variation very often found is the Belgian-made Colt, worthless weapons of inferior material. These are sometimes marked "Colt, New York," sometimes "Colt, London," but are mainly trade forgeries built for the export market.

The third broad group is the 1855, or Perfected Model Colt, made only in the U.S., and marked "Address Col. Colt, Hartford, Conn." These weapons have a side hammer and a solid frame and are rare in Europe. They were never popular and were rapidly superseded by the 1860–1861

group of Colts which represented a return to conventional centre hammer design. The Army model of this was made in hundreds of thousands and is the commonest of the muzzle loading ·44 Colts. The Navy model of ·36 calibre was less popular, but the Pocket model, a light version of the Army one, was widely distributed. The 1861 models were the New Pocket ·31, weight 25 to 28 ozs., the new model Police ·38, weight 24 to 26 ozs; the new model Navy ·36 calibre, weight 2 lbs. 10 ozs., the new model Army ·44 calibre, weight 2 lbs. 11 ozs.

The change from muzzle loading to breech loading models passes through a few conversions, which can be dated between 1865 and 1870, and is then renewed with the first Colt breech loader, the four chambered House pistol or Clover Leaf ·410 rim fire revolver. Two models of this exist, the ordinary short barrelled pistol and the octagonal barrelled Bull Dog with a stub barrel ¾ in. long. Both types are rare.

They are crude weapons, invented by C. B. Richards, and are far from the practical weapon designed by Colt.

The Colt Company, from 1865 on, bought ideas, and not always good ones. Their small solid frame non-ejector single action pocket revolvers were frail and unreliable compared to their robust predecessors. The 1870–1875 group cover ·22, ·30, ·32, ·38 and ·41 "New Line" revolvers of little merit. Not until 1873 do we come across the formidable Colt Frontier or Single Action Army revolver, which again restored the reputation of the concern. This was a return to the old Colt model of 1851, so far as shape of butt and detail of mechanism was concerned. It had, however, a solid frame and an ejector rod at the side of the barrel and was fitted with a loading gate. This arm achieved permament success and is still manufactured.

A variant of less popular type is the Colt Bisley, with a very deeply curved grip, a wide spoon trigger and an awkwardly placed short fall hammer. Essentially a target pistol, it achieved only limited popularity.

The double action Colt Army ·45 appeared in 1877, but here again only attained a doubtful popularity. There are three double action types, first the ·41 and ·38 Pocket pistols with no extractor, the same weapons with a rod ejector, similar to the Frontier model, and a heavy double action Army or Frontier model. This was a later and better design (1883), but lacked the dependable robustness of the single action Frontier.

In 1889 the ejector model swing-out cylinder ·38 Navy model appeared. Mechanically efficient it yet lacked the characteristic of natural fit and balance that made the reputation of the early Colt revolvers. The cylinder rotated anti-clockwise. This arm was very poor and was withdrawn and remodelled, but may become a rarity to collectors owing to its limited issue. The other modern Colts are mass production pistols of little interest. Of the automatics only the first type of ·45 with square handle and no safety grip device is likely to become rare.

Colt rifles, guns and carbines have very much less interest or value for the collector. The only outstanding pieces are the 1836 arms made at Paterson. They were made in ·38 and ·42 calibres and are hammerless. A separate trigger or ring lever was used to rotate the cylinder. A ·55 calibre shotgun was also made.

The next model is that of 1855, with the external side hammer similar to the 1855 pistol. These were made as rifles, carbines and shotguns in calibres of ·36, ·44 and the regulation ·56 for Service arms. The shotguns were of 16 and 13 guage. They are not particularly rare. In 1858 a ·70 calibre five shot "Elephant gun" was issued.

The main output of the Colt factories was military Berdan rifles and later, in 1885, repeaters of sporting type. They ceased to manufacture the latter before the close of the century. A certain number of Colt rifles and carbines were marketed from the London factory and were simply carbine models of the heavy old model Army pistol, 1848, but with long barrels and a permament carbine stock. In these the cocking of the hammer rotated the cylinder. Some parts for these were made at Birmingham and they were probably assembled and finished at Pimlico. Similar arms were also made at Liège in Belgium.

A representative collection of Colt revolvers can, without being exhaustive, reach to one hundred and twenty-five specimens without having a full range of barrel length and calibre to all types. Values depend greatly on condition, additional decoration, such as engraving on ivory or pearl butts. No specimens should be included in a collection unless the same component number appears on all parts.

The dates of appearance of their modern arms as follows:

Double-barrel shotguns, 1878.

Hammerless D.B. shotguns, 1884.

New Lightning Magazine rifles ·32, ·38, ·44, 1885.

Lightning Magazine rifles ·40, ·45, ·50, 1886.

·22 calibre R.F., 1887.

Colt's Pocket Double Action revolver ·32 calibre ejector, 1894.

·38 Navy D.A. ejector, ·32 D.A. New Police, 1895, New Service ·45 calibre Army revolver, 1898.

·38 Automatic pistol, 1900. The Pocket and Military models of this arm were issued in 1902.

In 1903 the ·32 Pocket Automatic pistol appeared.

In 1904 the ·38 Officer's Model New Service revolver appeared.

In 1905 we find the ·32/20 New Service type, the ·32 Police Positive and the ·45 Automatic pistol.

In 1906 the Police Positive ·38 calibre appears, and in 1908 the "Officers' Model" was improved and the "Army Special" in ·32/40, ·38 and ·41 issued in 4 in. and 6 in. barrel lengths, as was the Police Positive, a lighter weapon for the ·32/20 and ·38 cartridges. The ·25 Vest Pocket Automatic appeared in the same year.

The ·22 Police Positive Target appears in 1910, and the Pocket Automatics of ·32 and ·380 calibre have a new type of barrel mounting.

The ·45 Government Automatic pistol, with sloping grip, was adopted by the U.S. Government in 1911.

In 1915 the ·22 Automatic Target pistol was put on the market.

In 1916 an automatic disconnector safety was embodied in the ·25 Vest Pocket Automatic.

Minor variations occur in many of these pistols and revolvers, and specimens for the British market are chambered for British cartridges, such as the ·455 Elery or the ·455 Automatic Self-loader of the Canadian Forces.

APPENDIX II

SMITH AND WESSON ARMS

THE Smith and Wesson revolvers represent the finest grade of American pistol design, and were for many years the leading experts' almost unanimous choice. Ira Paine, Walter Winans, the author, and many other authorities of international reputation, held that the ·44 Russian single action breakdown model was the finest single action target revolver ever made.

Beginning with the Volcanic repeating pistol of 1854, Smith and Wesson first manufactured, or had manufactured for them, small seven shot solid frame ·22 single action revolvers. In 1855 the tip-up models of ·22 and ·30 rim fire appeared. By 1861 larger calibres of this type had evolved.

The change to breakdown appears to have taken place about 1868, when some bronze framed heavy calibre ·44 revolvers were made for the Frontier market. This design stabilised in 1870 as the S.W. Russian model of ·44 calibre, and was followed by a range of breakdown single action trigger guardless models in ·32 and ·38 central fire. In 1878 a trigger guard was added, and in 1880 the ·32 double action appeared. This was followed by the ·44 double action and ·30 double action in 1881.

In 1887 the ·38 Safety Hammerless, still the best revolver of its kind, was issued. The change to a solid frame side ejecting model was inspired, because shortly after 1900 the use of high pressure smokeless powder spread to revolver cartridges, and the heavy charges tended to jar the S.W. Russian model open at the breech. In 1902 the S.W. Perfected appeared. This was a breakdown action with a top catch and a central cylinder axis lock, as in the modern swing-out type. In the same year a small solid frame swing-out ·22 pocket revolver with an ejector rod lock was marketed. In 1905 the new rounded butt solid frame ·32 and ·38 side ejector swing-out models appeared. In 1907 the New Century ·44 and ·45 Service models

were issued. Later these were simplified and the housing for the extractor rod and the alignment devices improved. During the war a semi-circular three shot clip, taking the U.S. Government ·45 automatic cartridge, was adapted to the S.W. service pistol.

In 1911 the Smith and Wesson Company made a ·35 Pocket Automatic for a special cartridge. It was badly designed with very light moving parts and gave poor results. The manufacture was soon discontinued and the weapon is relatively rare.

APPENDIX III

SCOTCH WEAPONS

THE Scotch weapons possess an enhanced collector's value rather than any very radical virtue as arms, but they present particular aspects of historical interest. The earlier Scots' pistols and fusils of 1600–1610 are completely developed Moorish type snaphaunces, with the independent pan cover and a long armed steel or frizzen. These locks were made by the Moors without much change until the end of the 19th century. The original Moorish type was probably similar to the true Spanish lock, but very soon the external mainspring gave place to an internal one.

Their probable line of descent is from the match lock, through the pyrites lock, for the lock plate itself is even in modern examples basically the same as the 1560 type of pyrites lock and the spacing of the hammer axis and radius of fall are rather closer to the pyrites type than to the distinctive short fall flint action of the Spanish lock. A peculiar feature is a prominent disc end or cap to the flash pan. We find this in the Scotch snaphaunces as well.

The very early Scotch flint dog lock, figured among the illustrations of locks, shows the very typical Scotch swan-necked hammer, and it is mounted on a lock plate which has been made originally as a snaphaunce. The internal construction of a relatively modern Moorish snaphaunce lock is identical with the above lock, and the tumbler of both Scotch and Moorish locks is pierced to carry the moving rod of the snaphaunce pan cover sliding bar. The same features occur in many specimens and there is little doubt that we must accept Moorish influence as the predominant element in early Scotch design. To a lesser extent the peculiar scroll butts and up-curved inverted stocks of the shoulder arms indicate a further connection.

The early pieces are not all metal, but are long slender barrelled straight butted pistols, with the bend of the Italian wheel lock of 1560–1620. The tulip butt and flat pommel of this type of wheel lock appear on early Scotch snaphaunces. The tacke or dag was also made by the Scotch hammer men and we find Smith of St. Andrews, 1585, Alison and Gordon at Dundee, 1586, Alex. Pryde, St. Andrews, 1594, and many other makers follow on. No Scotch wheel lock is known to me, and it is fair to assume that the snaphaunces sent to Spain by James I of England and IV of Scotland in 1609 were not the first pieces made, but represented the best production of an already established technique.

Advancing a stage further we find that the dog lock mechanism which is of Scots association is also found on early Moorish pieces, and that it is probably a rudimentary survival from the scear release of the earliest pyrites or swipe locks, whose pan cover is identical with the flint lock, for which they have customarily been mistaken.

There does not seem to be any sound ground for doubting the existence of a crude flint lock of conventional type as a weapon in limited use by 1600. The simple steel and pan cover is already in existence on the pyrites lock, the hammer or cock is on the snaphaunce by 1580. The sliding pan cover of the true snaphaunce is a refinement borrowed from the wheel lock, and as a crude flint lock would be cheaper to make, it is probable that a coarse type of crude flint lock was in existence by the end of the 16th century and was applied more to pistols than to the shoulder arms.

We find in the Dresden and other Continental museums pistols of distinctively Scotch type—one snaphaunce is dated 1583. It is, however, doubtful if these arms are Scotch. It seems more probable that they are arms made on the Scotch model by German craftsmen. The same criticism also seems to hold good in regard to Scandinavian pieces. The latter countries were in close contact with Scotland, but also with Poland, and one or two pieces of Scotch type show the curious mid-Asiatic touch, distinctive of Polish work, in arms and armour. The Dutch influence which some writers appear to have noted is not manifest to the present writer. In general Dutch pieces were cumbrous, whereas the distinctive nature of the Scotch pieces is a rather remarkable portability and grace when compared with mid-European standards of the period. The native

arms were, after all, to be bought by mountaineers, and Low Country design was not as suitable as the Hispano-Moresque type.

The earlier snaphaunce pistols have often left-handed locks, probably because the right hand was occupied with a sword, and the pistol was a subsidiary weapon. Nevertheless, these left-hand locks also occur on guns. The barrels are often heavy gun metal, but the stocks are wood and scroll patterned. This yields, about 1620, to a tulip shaped pommel, and this slowly changes to a flattened indented sphere or kidney.

From 1650 onwards the tendency of the metalwork to encase all wood is noticeable, and by 1700 the all-metal pistol with the Highland scroll or ramshorn butt had evolved.

The dog lock feature of the Moorish locks, as a substitute for half cock, begins to give place to a half cock catch piercing the lock plate and holding the breast of the hammer.

The kidney shaped butt and also the egg or tulip shaped type endure in the all-metal pistols and pass through the first fifty years of the 18th century, but rather as rarities than as the true Highland type.

Decoration varies, and the best 18th century pieces have a pierced back extension with a cross ornament to the hammer or cock. The lock work of Scottish made pistols remains primitive and no bridle is used to balance the tumbler axis.

Of relatively large bore, and light and narrow in the grip, the later patterns must have been unpleasant weapons to use. The disarmament of Scotland after the rebellion of 1745 led to a scarcity of these weapons, and manufacture was only sporadically carried on. The Walter Scott boom in antiquities renewed the interest in Highland costume, and later pieces even percussion locks and under and over pistols with white metal butts were supplied to meet the demand.

The high prices paid for these Scottish weapons have resulted in a good deal of ingenious reproduction by careful, if non-ethical, craftsmen. Some excellent forgeries have sold for high prices under the hammer, and in no department of antique firearms is greater care needed. A competent expert should be employed to examine and report on weapons of this nature.

M. Georges Stalin's list of Scots makers is still the standard, but it

has recently been added to by Mr. C. E. Whitelaw, in his *Treatise on Scottish Hand Firearms of the XVIth, XVIIth, and XVIIIth Centuries.*

The influence of the Scots pistols taken abroad by mercenaries was very marked. The French small pistols with steel butts (the Segallas type) are known as *Écossais*, and all metal pistols of different kinds show the traditional influence. It must not be taken that the all-steel type is in all cases Scotch, for German dags of the 16th century and Italian holster pistols of the mid-17th antedate all known Scotch all-metal pieces.

APPENDIX IV

LIST OF SCOTCH PISTOL AND GUN MAKERS

THIS list is compiled from the original list due to the researches of M. George Stalin and embodies amendments by Mr. C. E. Whitelaw and the author. Initials on pistols may be read in opposite sequence.

A. C., 1619.
A. I., 1613.
A. R., 1614.
Achisone, Michæl, 1646.
Allan, Will, 1740.
Auchinleck, John, 1629.
B. J., 1613.
Bear, Robert, 1643.
Black, Wm., 1625.
Bruce, George, 1629.
Bruce, Thomas, 1632.
Brydon, W., Edinboro', 1800.
Burges, John, Elgin, 1700.
C. A., 1634.
C. A., *c.* 1770.
C. E., 1627.
C. I., 1650.
C. W., *c.* 1750.
Caddell, Thos., Doune, 1678.
Caddell, Thos., Doune, *d.* 1767.
Caddell, Robt., Edinboro', *c.* 1764.
Cameron, Alexander, *c.* 1725.
Campbell, Alexander, Doune, *c.* 1750.
Campbell, John, Doune, *c.* 1700 to *c.* 1800.
Campbell, W., Perth, *c.* 1740.
Christie, James, Perth, *c.* 1770 to *c.* 1800.
Chrystie, John, *c.* 1750.
Christie, John, Doune, *c.* 1750.
Christie, John, Stirling, *c.* 1775.
Clerk, James, 1626.
Clerk, Wm., 1626.
D. A., *c.* 1650.
D. F., *c.* 1725.
Dunbar, David, *c.* 1790.
Forbes, Al., Elgin, 1685.
Forbes, Alexander, *c.* 1770.
Fraser, John, Inverness, 1705.
G. A., 1622.
H. D., *c.* 1700.
H. I., 1615.
Hamilton, John, 1610.

Heriot, Wm., Edinboro', *d.* 1773.
Hunter, W., Stirling, *c.* 1750.
Innes, Francis, Edinboro', 1773.
Innes & Wallace, Edinboro', *c.* 1800.
I. H., *c.* 1725.
I. K., 1598.
I. L., 1614.
Lockhart, John, 1604.
Logane, Alexander, 1658 to 1671.
M. A., 1611.
M. A., *c.* 1680.
M. M., 1621.
M. M., *c.* 1650.
M. R., 1625.
M. W., 1673.
McAlaster, John, 1649.
McAllan, *c.* 1750.
McCulloch, Chas., Inverness, *c.* 1725
McKenzie, David, Dundee, 1707 to 1728.
McKenzie, James, Dundee, *c.* 1730.
McKenzie, James, I.A.M.K., Brechin, *c.* 1750.
McKlellane, John, 1611.
McNab, ? Dalmally, *c.* 1750.
McRosty, J., *c.* 1725.
McKlellan, John, 1626.
Michie, G., Doune, *c.* 1725.
Michie, J. A., Doune, *c.* 1750.
Millar, John, 1647.
Millar, James, 1688.
Mitchel, Wm., 1658.
Mitchell, J. O., *c.* 1750.
Mortimer, Edinboro', 1851.
Murdoch, Alex., *c.* 1770.
Murdoch, John, Doune, *c.* 1775 to 1800.
Murdoch, Thos., Leith, 1785.
O. I., 1725.
Orr, Robert, 1674.
P. A., 1635.
Paterson, James, *c.* 1800.
Petcairn, Jo., *c.* 1775.
Playfair, Aberdeen, *c.* 1810.
Reule, John, 1629.
Ross, Edinboro', *c.* 1810.
S. I., Inverness, 1667.
Scott, Andrew, *c.* 1725.
Scott, James, Edinboro', 1773.
Shiel, Jo., *c.* 1775.
Shires, Alex., Old Meldrum, 1700.

Smith, Gulielmus, Castle Grant, 1674 S. G., 1674 to 1686 S. W., 1672 Smyth, Robert, 1629	Probably the same maker.

Steuart, Daniel, 1690.
Strachan, Andrew Edzell, *c.* 1725.
Stuart, Jo., 1701.
Sutherland, James, *c.* 1790.
T. I., 1671.
W. A., 1670.
Wather, Daniel, Dumbarton, *c.* 1775.
Williameson, Gilbert, 1634.
Wilson, James, 1666.

APPENDIX V

A LIST OF SOME BRITISH GUNMAKERS, AND THE DATES OF SOME OF THEIR WORK

WHERE the date is given to a decade and a cipher is given as the last figure, this indicates that it is an approximation and not an exact date. The figures 1700, 1750, are in this way indicators only. A date given as 1703 or 1752 means verified from a dated piece, a silver mark, literary reference or other source. It should also be remembered that many of these makers continued as established businesses through several generations or that the name went with the business.

No attempt has been made to indicate concerns which were purely merchants rather than makers, but these can often be identified from their activities in other fields.

In general the list will be found to be accurate to a decade. But it should be remembered that the date or dates given are in most cases approximations and do not mean that a given maker began work in such and such a year and died or closed his affairs at the later date. The sense is that So-and-so was working from about —— till ——. Where an exact date is given this may be that of a piece made at any time in his career.

When a double name occurs on a weapon, it should be looked up under both names. In the case of initials, it should be remembered that the surname initial sometimes precedes the Christian name initial in old monograms.

Additions and corrections to this list will be welcomed by the author and should be sent to him care of the publishers.

Abnett, –	Windsor	1832
Achisone, Michael	Scotland	1646
Adams, Henry	London (Gray's Inn Road)	1850–58
Adams, Joseph	Birmingham	1770
Adams, Robert	London	1858–66
Adams & Co.	London	1870–99
Adams Patent Small Arms Co.	London	1864–92
Adcock, G. T.	London	1861–78
Addis, Thos.	London	1632
Ager, Wilson & Co.	London	1868
Aislabie	London	1740–50
Alard Fils, H.	London	1896–1900

Aldrige, Geo.	London	1714
Allez (N.)	Dublin	1760
Allot	Barnsley	1832
Allport, H.	Cork	1830
Allport, Thos.	Birmingham	1812
Allport, Thos. F.	London	1889–95
Allport, H. S.	London	1896
Anderson, Robert	London	1825
Anderson, John	Malton	1800
Anderson	London	1832
Anderson, Robert & Co.	London	1832
Andrews, Ben	Ross	1832
Andrews, C. W.	London	1882–1900
Andrews, Chas. E.	London	1900
Anens, S.	Unknown	1690
Antley, John	London	1864
Appleton, Henry M.	London	1869–72
Archer, Thos.	Birmingham	1780–1812
Archer, William	London	1775
Arden, W.	Dublin and London	1720
Arms & Ammunition Co.	London and Birmingham	1891–1900
Armbruster	London	1864–65
Ashton, Mrs.	London	1850–58
Ashton, T.	London	1856–57
Aspinal, T.	Birmingham	1812
Aston & Co. (?)	London	1864
Aston, Richard, & William	London	1869
Aston, W.	Manchester	1832
Atkin, Henry	London	1877–1918
Atkin, Henry	Chelsea, London	1862–70
Atkins, Henry E.	London	1874–87
Austen, Jacob	Birmingham	1689
Austin	London	1688
Austin, T.	London	1700
Automatic Rifle Syndicate	London	1896–1901
Ayres	Newbury	1800
Bacon	London and Birmingham	1870
Bagley, John	Birmingham	1812
Bailey	Newark-on-Trent	1759
Bailey	Maidenhead	1832
Bailey, T.	Stamford	1832
Baker, Ezekiel	London	1800–32
Baker, E., & Son	London	1850–60
Baker, E., & Son	London	1853
Baker, Thomas Kirslake	London	1851–1900
Bales	Ipswich	1832
Bankes	London	1685
Barbar & Harris	Birmingham	1779
Barbar, I.	London	1700–40
Barber	London	1760
Barber, T.	Newark	1785
Barn, John	London	1714
Barnes, Frederick	London	1850
Barnes & Co., Frederick	London	1900
Barnett & Son	London	1750–1825
Barnett & Son	London	1832
Barnett & Sons, John Edward		1850–75 1900
Barton	London	1810
Barton, L.	London	1820
Barton, T. (John)	London	1825–32
Barton, F., & Co.	London	1896–1900
Bate, Thos.	Birmingham	1812
Bates, John	London	1825–32
Bayliss & Son, E.	London	1874–76
Bays, Thos.	London	1785
Bear, Robert	Scotland	1643
Beary	London	1750
Beasley, Benjamin	London	1865
Beattie, T.	London	1845
Beattie, T.	London	1851–54
Beattie & Son, James	London	1865–79
Beattie & Co., T.	London	1879–94
Beck, T.	Bridgewater	1832
Beckwith, H.	Birmingham London	1851 1853–68
Beckwith, W. A. (William)	London	1825–60
Beddowes, John	London	1825
Bedford Bros.	London	1867
Bees	Bristol	1800
Beesley, Frederic	London	1879–1900
Bell, D.	York	1832
Benjamin & Burler	London	1861–82
Benjamin & Co.	London	1867–77
Benjamin, Henry	London	1872–82
Benjamin Pistol Syndicate (? air pistols)		1898
Benjamin Bros.		1869–71
Bennett	London	1780
Bennett	London	1775–1805
Benson, T.	London	1760
Bentley & Son	Liverpool	1851
Bentley & Playfair	London	1885–1900
Berry	Woodbridge	1840
Bevington, A.	London	1887–90
Bidet	London	1790
Biggs, F. T.	London	1876–86
Biken, I.	London	1681
Bingham, John	Birmingham	1814
Binney	London	1776
Bircham, Chas. O.	London	1867–1900
Birchett	London	1700–13
Birmingham Small Arms and Metal Co.	Birmingham London	1833–34 1885 to date
Bishop, William	London	1850–71
Bissell	Leith	1740–70
Bissel, Isaac	London	1780
Bissel, Thomas	London	1857–91
Biven, T. A.	London	1825–32
Black, Wm.	Scotland	1625
Blair	Birmingham	1790
Blair & Co.	Birmingham	1812
Blake	London	1790
Blake, John A. & Co.	London	1850–64
Blake & Co.	London	1832
Blake, T. A.	London	1825
Blakely	Birmingham	1862
Blakemore, V. and A.	London	1867–97

Blanch, John (several generations)	London	1809 to date
Bland, E. T.	London	1897
Bland, Thomas	London	1876 to date
Blissett, John	London	1850–77
Blisset, Sons & Tomes, John	London	1878–83
Blissett, Thomas	London	1864
Blissett	Liverpool	1837
Boales, T.	Newark	1832
Bolton, P.	London	1714
Bolton, R.	Birmingham	1812
Bond, E. T.	London	1810–40
Bond, G. E.	Thetford	1818
Bond, Edward and William	London	1850–61
Bond, Edward P.	London	1862–70
Bond, Edward Wm.	London	1871–79
Bond, W.	London	1768
Bond, Wm.	London	1812
Bond, Philip	London	1776
Bond, William	London	1825–32
Bond, W.	Thetford	1832
Bonehill, C. G.	Birmingham	1884
Bonney, G.	Preston	1832
Bonstead, F. (Fred)	London	1825–32
Boot, Richard	Birmingham	1812
Booth, Richard	Sunderland	1840
Borle, John	Birmingham	1770
Boss, Thomas	London	1850–59
Boss, Thos. & Co.	London	1860 to date
Boswell, Charles	London	1884 to date
Bosworth, John	London	1864–65
Bott, James & Son	London	1890–1900
Bourdeveaux, Peter	London	1864–65
Bourne, Wm.	Birmingham	1689
Bourne & Co., Joseph	London	1877–81
Bourne & Son, Joseph	Birmingham	1883
Bowdler	Salop	1800
Boyle, William	London	1893–94
Bozard & Co.	London	1888–97
Bozard, Bedingfields, Philip & Co.	London	1898–99
Braendlin Armoury Co.	Birmingham	1884
	London	1886–98
Brandon, Joel B.	London	1873–77
Bragg	London	1855
Brander, W. (several generations)	London	1637–1840
Brander, W. B.	London	(about 1750)
Brander & Potts	London	1825–32
Brasher	London	1790
Brasier, Wm.	London	1714
Brasier	London	1830
Brazier, T. R.	Wolverhampton	1851
Brazier	London	1760
Breech Loading Armoury Co.	London	1866
Breech Loading Gun Co. (Leitch's Patent)	London	1861–64
Brewer, Eugene G.	London	1877–85
Briden, George	London	1856 only
Brider, G.	London	1851
Brider, T.	London	1851
Bridgens, Thos.	Birmingham	1770
British Magazine Rifle Co.	London	1896–1900
Brielton	London	1770
Brompton	Doncaster	1785
Brompton	Doncaster	1800
Brooke	London	1680
Brooke, John	London	1714
Brooke, John, Senior	London	1714
Brooks, T. and R.	London	1686
Brooks & Son	Birmingham	1851
Brooks, Edward & Son	London	1853–54
Brown & Mannett	London	1867
Bruce, George	Scotland	1629
Bruce, Thomas	Scotland	1632
Brueton	London	1780
Bruie, Henry	London	1855
Brummit, S.	Nottingham	1832
Brunton, R.	York	1832
Brush, John	London	1714
Brush, R.	London	1701–09
Brush, A. R.	London	1705
Bull, T.	Bedford	1790–1851
Bulleid, T.	Bristol	1832
Bumford	London	1730–60
Bumford, I.	London	1695
Bunday, Jo.	London	1714
Bunn, William	London	1857
Bunney, Joseph	Birmingham	1770
Bunney	London	1720–40
Bunnie, M.	Berwick	1812
Burnett	Southampton	1840
Burges, John	London	1720
Burgin, Mary	London	1714
Burrows, Edwin	London	1878
Burrows, G.	Preston	1832
Burton, T. H.	London	1867
Bussey & Co., G. G.	London	1870–83
Bussey Ltd.	London	1884–89
Bye, Sarah	London	1714
Byrne, Chas.	London	1772
Burrows	London	1632
Cadiot, Emmanuel H.	London	1875
Caius & Frearn	Manchester	1790
Calderwood	London	1800
Calderwood	Dublin	1840
Calisher & Terry	London	1864–70
Calvert, T. W.	Leeds	1832
Calvert	Leeds	1807
Capner, Thos.	Birmingham	1812
Cardiffe	Unknown	1682
Carr	Lynn	1720
Carr, George	London	1864–65
Carr, W.	Lyme Regis	1832
Carter, Benj.	London	1718
Carter, Edwards (Pat. B. L. Co.)	London	1869–70
Carter, Frederick W.	London	1898
Carver, Alfred	London	1889–93
Carver, Robert	London	1865–79
Cartwell, T.	Doncaster	1832

Cash, James	Birmingham	1801
Chamberlain, John	London	1869–76
Chamberlain, Richard John	London	1877
Chamberlain, R. T.	London	1875–80
Chambers, John	London	1854–67
Champion	Southampton	1832
Chapman	Cranbrook	1820
Chapman, R.	Boston, Lincs.	1832
Chater	Ringwood	1790
Cherett, D.	London	1851
Cheshire, Wm.	Birmingham	1812
Child, W.	London	1830
Child, William	London	1850
Christie	Perth	1825
Christy & Co., T.	London	1868–75
Churchill, Charles	London	1869
Churchill, E. T., and Robert	London	1892 to date
Clabrough Bros.	London	1893–95
Clarborough	Lincoln	1832
Clark	London	1770
Clark, Chas.	London	1854–57
Clarke	London	1760
Clarke	Dublin	1800
Clarke, R. S.	London	1840
Clarkson (probably two generations)	London	1680–1740
Claude	London	1800
Clement, Chas.	London	1890–91
Clemmes, successor to I. Barbar, Shoe Lane	London	1750
Clemson	Shrewsbury, Salop	1832
Clemson	Salop	1740
Clerk, William and James	Scotland	1626
Clough, G.	Bath	1832
Cochrans (B. L. Fire-arms Co.	London	1868
Coffin, R.	London	1770
Cogswell, Benjamin	London	1850–62
Cogswell and Harrison	London	1863 to date
Cole, Elias	London	1716
Cole	London	1702–20
Cole	Devizes	1750
Cole, G. and Cole, R.	Devizes	1832
Cole, John	London	1866–97
Colesby, Ephraim	London	1857–59
Collett, Joseph	London	1718
Collicott	Bristol	1700
Collier, E. H.	London	1817–50
Collins	London	1820
Collins, Frederick	London	1861
Collins, James	London	1850–54
Collis, I.	Oxford	1800
Collumbell	London	1700–43
Colt, Colonel Samuel	London	1853–64
Conway	Poole	1832
Conway, T.	Manchester	1832
Conway	Manchester	1850
Conway, W. M.	Newcastle-under-Lyme	1840
Cook	Bath	1808
Cook	Lincoln	1832
Cook, J. T. & Sons	London	1850–55
Cook, T.	Shepton Mallet	1832
Cook, T.	Warminster	1832
Cook, W.	Bath	1832
Cooke, E.	London	1718
Cooper	London	1790
Cooper & Banks	Birmingham	1812
Cooper, Cooper & Goodman	Birmingham	1860
Cooper, G. C.	London	1890–93
Cooper, T. R. & Co.	London	1850–53
Cooper, T. R.	London	1840
Cooper, T. R.	Birmingham	1851
Cooper & Goodman	London	1876–80
Cornforth	London	1780
Cowper, T. (Crossbow maker)	Wrexham	1832
Coutts, William	London	1871–94
Crabb, George	London	1883
Cracknell	London	1740
Crane, T. H.	London	1866–79
Cressall, Henry	London	1856–57
Cressall, Williams	London	1858–73
Crips, H.	London	1647
Crodler, Thos.	London	1661
Cumming, Wm.	London	1871–74
Dafte	London	1660–82
Dalton, L.	Spalding	1832
Daniels, Cross & Co.	Birmingham	1812
Dawes, Wm. and Sam.	Birmingham	1812
Day, E. C. W.	Derby	1832
Day, Frank	London	1878–80
Darby, John	London	1866–70
Davidson, Duncan	Birmingham	1812
Davey, W.	Norwich	1832
Davies, T.	Oswestry	1832
Dawse	Maidstone, Kent	1780
Daw, George H.	London	1861–79
Daw & Co., G. H.	London	1870
Daw & Son, G. H.	London	1880–89
Daw Gun Co.	London	1890–92
Dawsten, Wm.	London	1632
Davenport, R.	Birmingham	1800
Davidson, Joseph	London	1790
Davidson	London	1800
Deacon, S.	Monmouth	1832
Deakin, T.	Stafford	1832
Deane, Adams & Deane	London	1851
Deane, George and John	London	1850–51
Deane & Co.	—	1852–53
Deane, Adams, and Deane & Co.	—	1854–57
Deane & Son, John	—	1858–72
Dee, Theo.	Birmingham	1750
De Grelle & Co. Chas.	London	1884–88
Delaney	London	1700–20
Delaney	Dublin	1800
Dennison, John	London	1718
Denyer, Bernard	London	1850–75

Demaret, Alexander	London	1893
Dermott	Dublin	1790
Dickinson, Herbert	London	1854–1900
Dixon, S.	Leicester	1832
Dobson, Jno.	Dublin	1770
Donald, Atkey & Co.	London	1872–75
Doubleday	Newark	1800
Doubleday, T.	Newark	1832
Dougall, James D.	London	1864–87
Dougall, James D., & Sons	London	1888–93
Dowling, Frederick	London	1865–77
Dresse Laloux Co.	London	1881–1900
Drew, John	London	1714
Drisket & Waroux	London & Liège	1870–72
Drisket & Co., A.	London & Liège	1874–76
Drury	Liverpool	1780
Drissen Fred	London	1876–79
Dunn, John	Birmingham	1770
Dupe	London	1760
Dutton, John	Birmingham	1812
Dumoulin & Co., F.	London & Liège	1898–99
Dunderdale, Mabson & Labron	Birmingham	1812
Dunderdale & Co.	Birmingham	1832
Dust	London	1790
Dust, John	London	1832
Dyball, Edward	London	1862–67
Dyer, Richd.	London	1714
Dyke & Co., Frank	London	1893–1900
Dylaney	Dublin and London	1700–20
Dylaney	London	1780
Eadon, T. (Gun and Crossbow maker)	Lancaster	1832
East, Edward & Co.	London	1874
Eaton & Co., Wm.	London	1868
Ebbutt, Lanc	London	1714
Edge, R.	Birmingham	1725
Edge	London	1759
Edge, T. W.	Manchester	1840
Edgson	Stamford	1830
Egan, Samuel G.	London	1888–93
Egg, B.	London	1750
Egg, Durs	London	1785–1834
Egg, D. I.	London	1832–65
Egg, Henry	London	1787
Egg, H. (Henry)	London	1851–69
Egg, Chas. and Henry	London	1850
Egg, Henry William	London	1870–80
Egg, Joseph	London	1780
Egg, Joseph	London	1822–35
Electric Arms and Ammunition Synd.	London	1892–94
Ellis, T. B.	Birmingham	1835
Ellis, Thos. B.	Birmingham	1822
Ellis, Richard	Birmingham	1897–98
Elvins, Amos	London	1867
Emme, John	London	1860–75
Enty, John	London	1825–37
Erskine, James & Co.	London	1869
Erskine, T.	Scotland	1851
European F. A. Co., Ltd.	London	1865
European Breech-Loading F. A. Co.	London	1868
Evans, Jas.	Carmarthen	1832
Evans, John	Carmarthen	1832
Evans, Robt.	Birmingham	1832
Evans, William	London	1883 to date
Evans Repeating Rifle Co.	London and U.S.A.	1878
Everard, Wm.	London	1718
Fairman, James	London	1850–68
Farlow	London	1780
Farlow	London	1702–13
Farmer, Joseph	London	1718
Farmer	London	1744–62
Farmer	London	1745–59
Farmer, G.	Cardiff	1832
Farnum	London	1746
Farquharson	Edinburgh	1872
Fatherby, T.	Leeds	1832
Felstead, Thomas William	London	1854–55
Ferguson	London	1774
Field	Aylesbury	1790
Field & Co., Alfred	London	1892–93
Field, John P. Co.	—	1862–66
Fisher	London	1670
Fisher	Bristol	1825
Fisher, Charles	London	1850–81
Fisher, Timothy	Ormskirk	1832
Fisher, William	London	1850–67
Fisherden	Tonbridge	1832
Fletcher, Thos.	London	1866–72
Fletcher, T.	Gloucester	1851
Fletcher	Gloucester	1825
Fletcher, W.	Tewkesbury	1832
Fliegenschmidt, Max	London	1887
Flood & Co.	London	1815
Ford, Richard	London	1860–68
Forrest	Oxford	1800
Forsyth & Co.	London	1812–52
Fort, T.	London	1710
Fort, Mary	London	1714
Forth, W.	Beverley, Yorks	1832
Fotherby, E.	Wakefield	1832
Franck, Ern. Fredk.	London	1879–80
Francotte, Auguste	London & Liège	1877–93
Fray, T.	Leicester	1832
Freeth, I.	London	1760
Freeman, Isaac	London	1683–1725
Freeman	London	1750
Freeman, James	London	1705–25
Freeth	London	1760
Frost	Peterborough	1780
Fullerd, W. (Barrel maker)	London	1832 to date
Fuller, George	London	1850–80
Furlong, Nicholas	London	1855
Furness, E.	Huddersfield	1832
Galton	London	1790
Galton, Sam	London	1812

Galton, Thos.	London	1780–95
Gamble, Wm.	Wisbech	1832
Gandon	London	1750–60
Gandon, Philip	London	1760
Garden, Robert S.	London	1861–91
Gardner, W. T.	London	1851
Gibbs	Bristol	1850 to date
Gifford Gun Co.	London	1892–93
Gilks, Charles H..	London	1857–63
Gilks, Wilson & Co.	Birmingham	1864–68
Gilks, C. H. Co.	Birmingham	1869–90
Gill, R.	Richmond	1832
Gill	Unknown	1750
Gill, Waters	Unknown	1725
Gillett	Bristol	1800
Gilletts	Bristol	1832
Glass, Thos.	Bridgnorth	1832
Glaysner, John	London	1865–70
Godsell, H.	Hertford	1832
Godsell	London	1740
Goff, Daniel	London	1804–32
Goff, Samuel F.	London	1879–89
Goldeche & Co.	London	1876–77
Golden	Huddersfield	1851
Golding	London	1820
Golding, Wm.	London	1850–59
Goldsworthy, T.	Taunton	1832
Gooch	St. Albans	1832
Goodall	Unknown	1790
Gore	Liverpool	1800
Gough and Bowen	London	1840
Gough, Robt.	London	1714
Gough, Mary	London	1714
Govers	London	1800
Gowling, Frederick	London	1735
Grainger, T.	Wolverhampton	1851
Grant, Stephen	London	1867 to date
Granville, Wm.	London	1857
Graves	London	1632
Gray, Samuel	London	1851
Green, Abram	London	1859–60
Green, John	Unknown	1775
Green, Thos.	London	1714
Green, William	London	1718
Green, William	London	1850–64
Green, William C.	London	1883–85
Green, William Charles	London	1870
Green, Wm.	London	1825–32
Greener, William W.	London and Birmingham	1878
Greener, W.	Newcastle	1829
	Birmingham	1844
Greener, W. W. Son	—	1869 to date
Gregory	London	1680
Grenfel & Accles	London	1892
Greville, Harston & Co.	London	1874–75
Grey	Dublin	1800
Grey, William	London	1858–72
Grice	London	1762
Grice, Wm.	Birmingham	1770
Grierson, Chas.	London	1825–32
Griessellich, Nebel & Co.	London	1869–76

Griffin & Son	London	1770–1800
Griffin	London	1740–70
Griffiths, Ben	Birmingham	1812
Grimshaw, Thomas	London	1850–56
Grimwade & Co.	London	1880
Groom, Richard	London	1858
Gulley, Joseph	London	1825–32
Gurney, Henry	London	1854–55
Gurney, John Henry	London	1864–65
Gye & Moncrieff	London	1876–87
Hackett, Edwin and George	London	1876–78
Hadley, Gilbert	Bristol	1741
Hadley, H.	London	1789
Hadley, Thos.	Birmingham	1770
Hall, Abraham	London	1664
Hall, Collinson	London	1825–32
Hall, I.	London	1727–70
Hall, John	London	1714
(Probable descendants A. Hall, 1664.)		
Hall & Powell	Dublin	1760
Hammond	Winchester	1840
Hampton	Birmingham	1812
Hancock, W. T.,	London	1891–99
Hanquet, Ferdinand	London & Liège	1870–71
Hanquet, T. B.	London & Liège	1872–78
Hanson, Chas.	London	1857
Hanson, S.	Doncaster	1832
Harcourt	Ipswich	1800
Harcourt, H.	Norwich	1832
Harcourt, John	Ipswich	1832
Harding, James	London	1825–32
Harding, Robt.	Ludlow	1832
Hardwick, T.	Ross	1832
Harold, Victor & Co.	London	1857–58
Harison, Simon	London	1714
Harper, I.	London	1801
Harris, John Holland	Unknown	1850–76
Harriss, Henry T.	London	1899
Harston, G., & Co.	London	1875
Hart, H.	Birmingham	1851
Harvey	Exeter	1840
Harway	Birmingham	1853
Harvard	London	1820
Hasdell, Thos. R.	London	1862–66
Hast, Fred E. W.	London	1856–59
Hattersley, T.	Boston	1832
Havers, W.	Norwich	1832
Hawker	London	1730
Hawkes, T.	Birmingham	1832
Hawkes, Wm.	Hull	1832
Hawkins	London	1670
Hawkins	Birmingham	1776
Hawkins, John, Senior	London	1714
Hawkins, John, Junior		
Haynes, James	London	1714
Hayward, Goodwin	London	1770
Haywood, W.	Chester	1832
Heasler, Wm.	London	1714
Heasler, Rchd.	London	1717
Hearder	Plymouth	1800
Heathcote & Evans	Birmingham	1812

Hecht & Co.	London	1897–98
Heeley	Birmingham	1790
Hellis, Chas.	London	1894–1900
Henricke (Head of Gun Trade)	London	1590
Henry Military Rifle Co.	London	1875–77
Henry Rifled Barrel Co.	London	1875–1900
Henry, Alexander	London	1869–99
Henry, Alexander, Ltd.	London	1897–98
Henry, Alexander Co.	London	1898–99
Henshall, Thos.	Birmingham	1812
Henshaw	London	1690
Henshaw	Strand, London	1780–1820
Heptinstall, William	London	1850–68
Hermann, Edwin	London	1890
Hetherington, T.	Nottingham	1832
Hewitt, John C. E.	London	1862–93
Hewson	London	1820
Hewson, Joseph	Exeter	1800
Heylin	London	1750–70
Heylin (probably two generations)	London and Birmingham	1770–1800
Heyns	London	1890–93
Hicking, Jos.	Birmingham	1770
Higgs	London	1780
Higham, G.	Warrington	1832
Hill, Abraham	London	1664
Hill, John	London	1825–56
Hill, W. J.	London	1872–79
Hillsdon & Jones, S.	London	1897
Hirst	London	1793
Hobday, Biddle & Co.	London	1800
Hobson & Co.	London	1815
Hobson, Frederick, & Co.	London	1896
Hodges, Edwin C.	London	1860–1900
Hodges, Lionel	London	1899–1900
Hodges, Perrin, & Co.	London	1861
Hole, W.	Bristol	1832
Hollands, Edward	London	1864–75
Holland, James, & Sons	London	1850–58
Holland & Holland	London	1877 to date
Holler, A. E.	London	1858–70
Hollis, A., & Co.	London	1897
Hollis, Isaac, & Sons	—	1870–1900
Holmes, Henry	Liverpool	1832
Holyoak	London	1720–50
Homer, Thomas	London	1825–32
Hood, A.	York	1832
Horton	Salop	1830
Hosey, John	London	1668
Hoskins, John	London	1850–52
Howell, Wm.	Birmingham	1812
Hubbard, Michael T.	London	1874
Huggins, Wm.	London	1714
Hughes, Robert	London	1869
Hulbert, C.	Shrewsbury	1832
Hunt, John	London	1770
Hunt, Thomas	London	1875–82
Hunter	Birmingham	1775
Hunter	London	1780
Hunter	Edinburgh	1820
Hurst	London	1799

Hussey, H. J.	London	1900 to date
Hutchins, John	London	1861–65
Hutchinson & Lord	Dublin	1775
Huzzey, Richard	London	1881–97
Innes	Birmingham	1820
Ionas	Unknown	1680
Jackson	Nottingham	1800
Jackson	London	1830
Jackson	Maidstone	1832
Jackson, Chris	London	1714
Jackson, George	Birmingham	1812–32
Jackson, J.	Nottingham	1832
Jackson, Richard	London	1825–69
Jackson, Richard and Elias	—	1870–72
Jackson, Richard	—	1873–97
Jackson, Thomas	London	1850–79
Jackson, Thomas, junr.	London	1861–62
James, Enos	Birmingham and London	1880–89
James, H.	London	1840
Janssen, J.	London	1876–96
Jaques	London	1815
Jarrett, Henry T. & Co.	London	1870–71
Jaynors	Unknown	1800
Jeffery, W. T.	London	1888–1900
Jefferys	Tadcaster	1800
Jeffries	Norwich	1862
Johnson, John	London	1714
Johnstone, Pat.	London	1832
Jonas, John	Birmingham	1812
Jones, Chas.	London	1833
Jones, G.	London	1730
Jones, Geo. E.	London	1790
Jones, John	Liverpool	1800
Jones, T.	Wrexham	1832
Jones	Cornhill, London	1800–33
Jones, Wm.	London	1812
Jones, Wm. P.	Birmingham	1897–98
Jordan	London	1733–60
Joselyn, F. A., Co.	London	1867–68
Joseph & Co., Solomon	London	1870–76
Jourson	London	1720
Jover, Wm.	London	1750–75
Jover & Belton	—	1786
Joyner	London	1765–1810
Keen, Job, junr.	London	1850–66
Kemp, Bros.	London	1859–60
Kemp, Leddall, & Co.	London	1860–62
Kerr, James, & Co.	London	1870–94
Kerrison, John	London	1832
Ketland (Merchants)	Birmingham	1740–1832
Ketland, T.	Birmingham	1750–1829
Ketland & Walker	Birmingham	1750–1829
Kimbley	London	1750
Kmbley, B.	Leeds	1832
King, T. J.	Bristol	1851
Kipling, Chas.	London	1714
Kirk	London	1790
Kirkham, Henry	London	1716

Kirk, W.	Birmingham	1764
Kitching	Darlington	1820
Kleft, W. H.	London (?)	1780
Knight	Bristol	1815
Knight, Y.	Oxford	1800
Knubley	London	1750
Koster	London	1620
Krauss-Klein Paul,	London	1871–73
Kysling, Richd.	London	1714
Lacey & Co.	London	1776
Lacy & Reynolds	London	1840–53
Lacy & Witton	London	1825–40
Laird, J. W.	London	1889–96
Lamblin, L., & Co.	London & Liège	1868–93
Lancaster, Chas.	London	1832
Lancaster, Chas. Wm.	—	1850–54
Lancaster, Chas. Wm. and Alfred	—	1855–60
Lancaster, Chas. Wm.	—	1861–67
Lancaster, Chas. Wm. & Co.	—	1879
Lancaster, Chas.	—	1882 to date
Lane, Charles	London	1889–1900
Lane, George J.	London	1879
Lane, Thos.	Birmingham	1770
Lane, T.	Worcester	1832
Lang, Edward	London	1880–89
Lang, H. J.	Solingen and London	1867–69
Lang, James	London	1887
Lang, Joseph	London	1850–74
Lang & Hussey	London	1896–1900
Lang, J., & Son	London	1875–98
Lang, T., & Co.	London	1898 to date
Lawton, A.	London	1861–6
Lawrie, J.	Leicester	1832
Laycock, S.	Sheffield	1832
Leeson, Wm. N.	Ashford and London	1899–1900
Leigh, John	London	1850–64
Leigh, James	London	1825–32
Leitch, James	London	1860
Lemman	Battle	1815
Leonard, D.	London and Birmingham	1880–1891
Le Personne & Co., L.	London	1894–1900
Levin, Moses L.	London	1885–88
Lewis, T.	Carmarthen	1832
Liege F. A. Mfg. Co.	London	1867–80
Lill	Louth	1832
Ling, Wm.	London	1850–62
Little, G., & Co.	London	1889–96
Lock, A.	London	1810
Locke, W., & Watts	London	1882–92
Loewe Ludwig Co.	London	1892–98
Lohmeyer, Tait & Co.	London	1889
Lombard & Butler	London	1825
London Armoury Co.	London	1857 to date
London, Birmingham, and Foreign Armour Agency	London	1864–68
London, B. L. F. A. Co.	London	1882–84
London, Edward	London	1850–72
London F. A. Co.	London	1886–87
London Gun Co.	—	1888 to date
London, S. A. Co.	—	1867–1918
London, William	London	1825–40
Loneux, Andrew and Cuasce	Liège and London	1865–66
Long, Richard, & Co.	London	1867
Lordon	London	1744
Lott	Canterbury	1780
Love, Samuel	London	1689
Low, Thomas	Chester	1832
Lowdell	Lewes	1800
Lowe	London	1700
Lowe, Samuel	London	1720
Lowe	London	1800
Luneschloss, John D.	London	1867–68
Mace	Reading	1810
Macguire, John	London	1865–87
Machie, James	London	1879–93
Mackenzie Bros.	London	1881–94
Maleham, Chas. H.	London	1878–1900
Manchester Ordnance Rifle Co.	Manchester	1865
Manners, Edward	London	1845
Manning, James	North Walsham	1832
Manton, John	London	1797
Manton, Joseph	London	1766–1835
Manton, John, & Son	London and Calcutta	1832 to date
Manton, J., & Co.	London and Calcutta	1870–74
Manton, J., Son, & Co.	London and Calcutta	1874–77
Marnes, T.	London	1850–68
Marnes, William	London	1871–81
Marres, Joseph	London	1878–93
Marson, S., & Co.	Birmingham	1890
Martin	Paisley	1840
Martin, Arthur	London	1886–90
Martini-Henry B. L. & Enfield Co.	London	1877–1900
Martini-Henry Rifle Co.	London	1878–79
Martyn	London	1790
M'ary	Newbury	1832
Masu, Gustave	London	1864–82
Masu Bros.	—	1883–92
Matner	Newcastle	1825
Matherbe, Joseph Philip	Liège and London	1854
Matherbe, Prosper, & Co.	London	1858–61
Maxim Gun Co.	London	1886–68
Mayer	Norwich	1850
Mayo, Sam	Birmingham	1812
Mazor, J.	Yarmouth	1832
McCarthy, Buck & Co.	London	1899–1900
McCormick	Belfast	1800
McDermot	Dublin	1790–1820
McEntee & Co.	London	1885
McKenzie, D.	London	1720
McWilliam, J. T.	London	1861

Mears, Bros.	London	1886–92
Melland, G. S.	London	1861–67
Memory	London	1793–1810
Mewburn, O. R., & Co.	London	1874
Mewis & Moseley	Birmingham	1790
Midland Gun Co.	Birmingham	1890 to date
Mills, W.	London	1823
Moggridge, J. J.	London	1850
Monck, I.	Stamford	1832
Mont, Storm Wm.	London	1865–71
Moore	Birmingham and London	1689
Moore	London	1793–1801
Moore, Charles	London	1825–32
Moore, D.	London	1750
Moore & Grey	London	1850–53
Moore & Woodward	London	1850–72
Moore, Williams & Co.	London	1854–72
Moore, Wm., & Grey	London	1872–1900
Morgan, Wm., & Co.	London	1868–69
Morris Aiming Tube	London	1883–1910
Morris, Henry	Birmingham	1812
Morris, Isaac	London	1714
Morrison, S.	Norwich	1832
Morter, Wm.	North Walsham	1832
Mortimer & Son	Edinburgh	1879–83
Mortimer, T. E.	Edinburgh	1851
Mortimer, Thomas	London	1825–32
Mortimer, Thos. J.	London	1825–32
Mortimore, H. W.	London	1780–1800
Morton, Wm.	London	1876–88
Moseley, Joan	Birmingham	1812
Mosley, E.	Sheffield	1832
Moxham, Thos.	Birmingham	1812
Muler, Martin H.	London	1675–89
Mulley	Dublin	1760
Murcott, Theophilus	London	1861–78
Museum of Firearms	London	1870–75
Mustow, R. J.	London	1854
National Arms and Ammunition Co.	London	1873–77
Needham, Henry	London and Birmingham	1854–56
Needham, William	London	1843–51
Needham, William and Joseph	London	1352–53
Needham, T., & Co.	London	1854–70
Needham, Joseph and Henry	London	1870–80
Neill, A.	Belfast	1850
Nelson, I.	London	1710
Nelson, I.	Portsmouth	1730
New	Birmingham	1832
Newby, Edwin Henry	London	1867–1900
Newton	Grantham	1776–1815
Nicholls, Tom	Oxford	1815
Nicholson, Edmund	London	1610
Nicholson	London	1808
Nicholson, E. D.	London	1780–1810
Nidzer	Norwich	1832
Nock, Jover, & Green	London	1775–80
Nock, Henry	London and Birmingham	1775–1810
Nock, Samuel	London	1812–62
Norcott, John	London	1632
Norman, Benjamin	London	1869–71
North, George	Winchester	1832
North, Thomas	Southampton	1820–32
Norton, Henry	London	1832
Noys, R.	Warminster	1832
Nutt, Wm.	London	1714
Nye, Nathaniel	Worcester	1649–60
Oakes	London	1718
Oakes	London	1790
Oakes, M.	London	1800
Oates	London	1780
Oliver, H.	Maidstone	1780
Onions, John	Birmingham	1770
Onion & Wheelock	Birmingham	1840
Ortmann, H.	London	1889–90
Osborne, C.	Birmingham and London	1851 to date
Osborne, John	Birmingham	1770
Oughtom, Joseph	Birmingham	1780
Outridge, R.	Birmingham	1793
Outridge, R.	London	1830
Oxborough	Woodbridge	1850
Page	Norwich	1776
Paine, James	London	1851–52
Palmer	Rochester, Kent	1790
Palmer	Brighton	1790
Palmer, Wm., and H. E.	Rochester	1797
Parat	Derby	1820
Parke, W.	London	1845
Parker, W. (maker of Police Pistols)	London	1800–40
Parker, Field & Sons	London	1850–86
Parker, N.	London	1827
Parker, Wm.	London	1825–32
Parkes	Birmingham	1770
Parkhouse	Taunton	1840
Parkhouse, T.	Taunton	1832
Parkin, Thomas	London	1825
Parkin, Mrs. E.	London	1857–60
Parkin, Thos.	London	1861
Parkinson, Luke	Boston, Lincs.	1832
Panett	Salisbury	1760
Parsons	Swaffham, Norfolk	1851
Parsons, T.	Salisbury	1832
Parr, I.	London	1680–1710
Parr	London	1750
Pasmore, John	London	1640
Patent B. L. Rifle Co.	London	1864–67
Paton & Walsh	Perth	1860
Paton, Edward, & Sons	London	1871–85
Patrick, Ann	Liverpool	1832
Pattison, M. J.	Dublin	1800–40
Pauly, Jean Samuel	London	1814–16
Peabody, B. Loader	London	1869–77
Peddal, James	London	1714

Peddell	London	1685
Peele, T.	Whitehaven	1720–25
Peevel, Joseph	London	1878
Penn, John	London	1867–80
Penn, William T.	London	1873–99
Pepper	Bedford	1820
Perin, S. T.	Windsor	1830
Perkes, Thos.	London	1882–95
Perkes, Adams, & Co.	London	1896–98
Perkins	London	1840
Perry, Wm.	London	1866
Perry	London	1780
Perry, Wm.	Birmingham	1780
Philips, Thos.	London	1714
Philips, Frank	London	1714
Philipps	London	1868
Philipps, H.	London	1885–86
Pickefatt, C.	London	1660–80
Pickfatt, Humphrey	London	1714
Piercy, M.	New Malton	1832
Piper	Windsor	1832
Piper	Cambridge	1850
Pollard, Wm.	London	1825–40
Pollard, William H.	London	1877 to date
Porter, T.	London	1780
Portlock, John	London	1868–70
Portlock, Godfrey	London	1879
Portlock, T.	London	1880
Pottage, T.	Wakefield	1832
Potter, T.	London	1840
Potts, T. H.	London	1850–53
Potts & Hunt	London	1854–74
Powell	Dublin	1830
Powell, Hugh	London	1716
Powell, Stephen	London	1714
Powell, Wm.	Birmingham	1884 to date
Powell	Birmingham	1851
Pratt, T.	York	1832
Predden, Wm.	London	1714
Press, E.	Bristol	1800
Price	Birmingham	1762
Prince	Portsmouth	1835
Prince, Frederick	London	1859
Pringle, John	London	1716
Pritchett, Richard E.	London	1825–55
Pritchett, R. T.	London	1856–64
Probin, John	London	1840–51
Probin, Thos.	London	1718
Probin, T.	London	1775–1810
Probin, Thos. & Chas.	Birmingham	1770–1812
Proctor, Wm.	London	1846–49
Prosser	London	1770–1800
Prosser, W.	Gloucester	1832
Providence Tool Co. Armoury	London	1867–69
Prudie, Henry	London	1888
Pryse, John & Co.,	London	1874
Pryse, Chas., & Co.	London	1875–88
Pryse, Thos., & Lewis	Birmingham	1889–93
Puckle	London	1718
Purcell, Benjamin	Richmond	1832
Purdey, James	London	1825–78
Purdey, James, & Sons	London	1878 to date

Pye	Ross	1785
Radoe	Norwich	1590
Raick Freres	London and Liège	1898–1900
Raper	Leeds	1832
Rawlins, John	Birmingham	1835
Rea, John	London	1793
Rea, T.	London	1825–32
Reddell	London	1750
Reddell & Co.	Birmingham	1812
Redfern	Birmingham	1790
Redman, Richard	Birmingham	1887–88
Reed, Archibald	London	1850–58
Reeve, Wm.	Yarmouth	1832
Reeves	Birmingham	1812
Reeves, Chas.	London	1860–62
Reeves, T. & Co.	Birmingham and London	1883–92
Reilly & Co.	London	1859 to date
Reilly, Edward M.	London	1850–98
Reilly, Joseph Chas.	London	1850–58
Remington Arms Co.	London	1876–79
Restel	London	1855–65
Reynolds, Thos.	Birmingham	1812
Reynolds & Forbes	London	1790
Reynolds, Thos.	London	1825–32
Reynolds, W. Cook	London	1897–1900
Rhoades, C. T.	Salisbury	1832
Richards, J.	London	1700
Richards, T.	London	1700–30
Richards	London	1700–30
Richards	London	1832
Richards, Thos.	Birmingham	1770
Richards, John	Birmingham	1770–1812
Richards, Theo.	Birmingham	1812–32
Richards, Westley	Birmingham	1820
	London and Birmingham	1850 to date
Richardson, J.	Birmingham	1820
Richardson	Manchester	1790–1832
Ridley, Thos.	London	1825–32
Ridley, Williams	London	1825–32
Ridley, Thos.	London	1861–62
Rigby, John	Dublin	1842–67
Rigby, John	London and Dublin	1867 to date
Rigby, W. T.	Dublin	1827–67
Riley, Wm. S.	Birmingham	1874–87
Rippingile, E.	London	1851
Riviere, Henry	London	1853–66
Riviere, Isaac	London	1825–51
Robb, Andrew	Aberdeen	1821
Roberts, George, junr.	London	1856–60
Roberts, T.	Birmingham	1867
Roberts, John	London	1852–68
Robertson, John	London	1874–1900
Robinson	Bristol	1770
Robinson	London	1792
Robinson, John	Liverpool	1832
Robinson, A.	London	1851
Rock, Denis T.	London	1871–72

Rogers, T. F.	London	1887–88
Rogers, William	London	1891
Rose, James	Birmingham	1812
Rose, Wm.	London	1714
Ross, John	London	1896–98
Rotsipen, Arnold	London	1635
Rowland, Henry	London and Birmingham	1632
Rowland, R.	Birmingham	1718
Rowland, G.	London	1830
Rutter, William	London	1850–57
Ryan & Watson	Birmingham	1780
Sale, Edward	London	1714
Scarlet, D.	Swaffham	1832
Schlesinger, Joseph	London	1856
Schulte, Charles	London	1871–72
Schwarte & Hammer	London	1885–1900
Scott, Walter	Edinburgh	1873
Scott, W. W.	Birmingham	1874
Scott, William	London	1850–53
Scott, W. & C., Son	Birmingham and London	1873–1900
Searle, Thomas	London	1869–71
Seddon, James	London	1850
Sezdel & Co.	Birmingham	1877–79
Shambles, G.	Barnsley	1832
Sharp, Wm.	Birmingham	1832
Sharp, Mrs.	Birmingham	1840–56
Sharpe, John	Birmingham	1812
Shaul, William	London	1890–1900
Shaw	London	1790
Shaw, Wm.	Manchester	1832
Shearing, F., & Co.	London	1899–1900
Shepard	Uxbridge	1800
Shepherd, W.	Canterbury	1770
Sheppard, John	London	1760
Sheppard	London	1817
Sherwood, J. W.	London	1825–32
Shirls	London	1795
Shirts	London	1795
Showell, C.	Sheffield	1832
Shuttleworth, S.	London	1877
Sibley, John	London	1714
Sibthorpe, Robt.	London	1714
Siddel, W.	Chester	1832
Silver & Fleming	London	1886–97
Silver, S. W., & Co.	London	1882–98
Silver & Edgington	London	1899–1900
Simkin, Ben	St. Helens, Lancs.	1832
Simmonds, Joseph	Birmingham	1812–32
Simpson, W.	London	1700–15
Sinckler, Rchd.	London	1714
Sladden Bros.	London	1873
Smart, Francis	London	1714
Smart, John	London	1800
Smart, W.	Gloucester	1832
Smith	London	1747–1832
Smith, Chas.	Birmingham	1897–1900
Smith, C. T.	London	1850
Smith, Edwin	London	1870
Smith, G.	Newcastle-under-Lyme	1832
Smith, George	London	1859–97
Smith, John	Birmingham	1812
Smith, Thomas	London	1850–60
Smith, Mrs. E.	—	1861–62
Smith, R.	Uttoxeter	1832
Smith, T.	Leek	1832
Smith, Samuel and Charles	London	1809–75
Smith, W.	London	1825–32
Smithett, Geo.	London	1714
Smythe, Joseph F.	Darlington	1895–97
Snider Rifle and Cartridge Co.	London	1878–79
Société Anonyme Commerciele Belge	London	1884
Southall, John	Birmingham	1770–1817
Southgate & Mears	London	1884
Southgate, Thos.	London	1896–1900
Southwell, William	London	1836–70
Sowerby, Wm.	London	1714
Spearman, T.	London	1850–64
Spencer	London	1820
Spencer, Joseph	Birmingham	1812
Spencer, M. S.	Lyme Regis	1832
Squire, W.	London	1777–1878
Squires, James	London	1860–92
Squires, John	London	1893–96
Squires, William	London	1854–57
Squires, W.	London	1832–51
Stace, Jos.	London	1680
Stacey, Benjamin T.	London	1887–94
Stacey & Co.	London	1895–1900
Standenmeyer, S. H.	London	1825–32
Stanley	London	1825
Stanton	London	1778
Stanton & Son	Chester	1850
Stanton, S.	Shrewsbury	1832
Stapp, Richard	London	1853–58
St. Aubin, Gaston de	London	1894
Stephen, R.	Bristol	1832
Stevens, James	London	1832
Stevens, Thomas	London	1832
Stewart, P.	London	1861–71
Stocker, T.	Yeovil	1832
Stocker, S. W.	Bristol	1832
Storer, David	London	1852–53
Storms, B. C. Arms Depot	London	1864–65
Stringer	London	1750
Stringer, Ralph	London	1714
Stringer, William	London	1850–68
Sturman, George	Islington, London	1830
Sturman, Philip	London	1825–32
Sturman, W.	London	1832
Sturman, George	London	1850–70
Sturman, Benjamin	London	1850–57
Styan, T.	Manchester	1832
Such	Worcester	1800
Such, Joseph	Birmingham	1812
Summers & Stanley	London	1800
Sutherland	London	1790
Swinburn & Son	London	1860
Sykes	Oxford	1820

Sykes, Thos.	London	1794
Sylven, Thomas	London	1864–80
Tambeur, Bernard	London	1866–68
Tanner, L.	London	1795
Tate, B.	London	1832
Tatham, Henry	London	1800–60
Taylor, Ed.	Birmingham	1770
Taylor	London	1800
Taylor, W.	Beverley	1832
Templeman	Salisbury	1789
Teray	Dublin	1790
Terry	London	1853
Thayer & Co.	London	1878
Thomas	Birmingham	1790
Thomas & Storrs	London	1800
Thompson, John	London	1717
Thompson, W.	Birmingham	1812
Thomson, J.	London	1832
Thorn, William	London	1874–76
Thumann, A.	London	1893–94
Thwaite	Bath	1760–80
Tilly, E.	Birmingham	1690
Timmings	London	1800
Timmings, Ed.	Birmingham	1812
Tipping	Bath	1832
Tippin	London	1746
Tipping & Lawden	Birmingham	1850–77
Tittensor, John	London	1714
Tocknell	Brighton	1832
Toldan	Unknown	1745
Tolley, F. & W.	London	1883–84
Tolley, S. W.	Birmingham	1885–1900
Tolley, Henry	Birmingham	1890–91
Tomes, W. T.	London	1864
Tomes & Co.	London	1884–85
Tomlinson	Dublin	1790
Tow	London	1770–90
Towle, Thos.	London	1714
Towle, Eliz.	London	1714
Towlson, T.	Marlborough	1830
Townsend, S.	Birmingham	1851
Treeby, W.	London	1855
Treeby, Thomas	London	1861–62
Treville, Harston & Co.	London	1876
Truelocke	London	1667
Trulock & Son	Dublin	1851
Tulloch, William	London	1893–1900
Turner, John	Birmingham	1812
Turner, Thos. Henry	Reading	1838
Turner, Henry	London	1850–62
Turner, S.	Manchester	1780
Turner, T.	Halifax	1832
Turner, T.	Marlborough	1832
Turner, Thomas	Birmingham	1872–79
Turner, Thomas	London	1884–93
Turner, S.	London	1776
Turney, Henry	London	1864–71
Turney, J.	London	1825–32
Turvey, Edward	London	1714
Turvey, William	London	1720–54
Twigg	London	1770–80

Utting	London and Birmingham	1800–20
Van Zaylen, Prosper	London	1857
Vanshan	Birmingham	1744
Vaughan, John	London	1714
Vercomb	Bristol	1720–70
Vernon	Bristol	1760
Victoria S. A. Coy.	London	1900
Walker	London	1700–39
Walker, D. L.	Dumbarton	1750
Walker	Birmingham	1790
Walker	Beccles	1832
Walker, I.	London	1806
Walker, Daniel	Dumbarton	1810
Walker, I.	Norwich	1832
Walker, B.	Birmingham	1851
Walker, Sarah	Birmingham	1851
Walker, William	Scotland	1626
Walklate	London	1815
Wallace	Dublin	1780
Waller, James	London	1774
Waller, Richd.	London	1718
Wallis, G.	Hull	1820–32
Wallis, John	London	1859–64
Wallis, R. T.	London	1892–1900
Walsingham, Wm.	Birmingham	1770
Walters, George	London	1850–57
Ward, Henry	London	1876–79
Ward, Henry	Birmingham	1880–1900
Ward, Richd.	London	1718
Ward, H. A.	Birmingham	1883–1900
Ward, T.	Warrington	1832
Warson, John	London	1716
Warrilow, T. B.	Chippenham	1891–93
Waters	London	1732–76
Waters, John	Birmingham	1770
Watson	London	1810
Watson	Birmingham	1832
Watson, James R.	London	1892
Watson, John	London	1632
Watson, John	Birmingham	1900
Watson, Thos. W.	London	1878–84
Watson, Bros.	London	1885 to date
Watson, William, & Son	London	1868–85
Watson & Hancock	London	1886–90
Webley, P., & Son	Birmingham	1884–98
Webley & Scott Revolver Arms Co.	London	1898 to date
Webster & Co.	London	1825–32
Webster, W.	London	1851
Webster, William	London	1854
Webster & Co.	London	1832
Welch & Co.	London	1770–90
Welch	Banbury	1810
Welch	London	1750
Welch, John	Birmingham	1770
Wells, T. H.	London	1891–92
Westley Richards	Birmingham	1832 to date
West, Tom	Birmingham	1689

Weston, Edwd.	London	1714
Weston, Richard	Birmingham	1689
Weston	Lewes	1832
Westwood	London	1800
Whateley, T.	Birmingham	1770
Wheeler	London	1771
Wheeler	London	1808
Wheeler, Charles	London	1854
Wheeler & Son	London	1820
Wheeler, Cornelius	Bridgnorton	1832
Wheeler, Robert	Birmingham	1770
Whistler, Edward	London	1856–1900
White, E.	London	1850–88
White, Thos.	London	1714
White, John	London	1716
Whitehead, Thomas	London	1850–52
Whitmore, Thomas	London	1871
Whitworth & Co.	London	1866–69
Whitworth, Sir Joseph, & Co.	Manchester	1871
Whitworth, Sir Joseph, & Co.: Ltd.	Manchester	1879
	London	1888
Wicksted	London	1775
Wiggett, T., & Sons	Birmingham	1891–92
Wiggin & Co.	London	1810
Wightman, W.	Malton	1820–32
Wilbraham, George	London	1825–32
Wilbraham, John	London	1854–60
Wilbraham, Joseph	London	1851–56
Wilford, Richd.	London	1714
Wilkes	London	1810
Wilkes & Harriss	London	1894–1900
Wilkins	Grantham	1832
Wilkinson & Son	London	1851
Wilkinson, James & Son	London	1820–89
Wilkinson Sword Co., Ltd.	—	1890 to date
Wilks	London	1790
Willets	Birmingham	1745
Willett	Dublin	1810
Willetts	Birmingham	1789
Williams & Powell	Liverpool	1881–92
Williams, Ben	Birmingham	1770
Williams, Frederick	Birmingham	1893–1900
Williams, John	London	1714
Williams, Henry	London	1854–80
Williamson, Bros.	London	1868–75
Williamson, Robert	London	1865–66
Williamson, William	London	1878–90
Willison, Archibald G.	London	1873–74
Willmore	London	1689–1700
Wilmore, John	London	1677–1700
Willoughby	London	1790
Willoughby, R.	London	1775
Willowes, John	London	1716
Wilson, Alex.	London	1825–32
Wilson, Alfred	London	1875–87
Wilson, Archibald	London	1850
Wilson, Henry T.	London	1888
Wilson, James	Scotland	1666
Wilson, John	London	1856

Wilson, Richard	Birmingham	1770
Wilson	London	1717–37
Wilson, R.	London	1681
Wilson, Thomas, & Co.	London	1869–71
Wilson, William	London	1825–32
Wilson, W.	London	1770
Winchester Repeating Arms Co.	London	1882–1900
Winton, H.	Birmingham	1851
Wiswold, L.	Gainsborough	1832
Witton, David William	London and Birmingham	1854–56
Witton Bros.	London and Birmingham	1857–69
Witton, John	London and Birmingham	1850
Witton, Daw & Co.	London and Birmingham	1851–53
Witton & Daw	London and Birmingham	1851
Witton & Daw	London and Birmingham	1854–60
Witton Small Arms	London and Birmingham	1874–78
Wogdon	London and Dublin	1770–1800
Wogdon & Barton	London	1760–80
Wolldridge, R.	London	1680–1739
Wood, W.	Worcester	1832
Woods, Edmund, & Son	London	1864–70
Woods, Edmund	London	1871–91
Woods	Birmingham	1832
Woodward, T.	London	1850
Woodward, James, & Sons	London	1873–1900
Wooldridge, A.	London	1680–1739
Woolley	Birmingham	1832
Woolloms & Co.	London	1867–72
Wright, G. E.	London	1900
Wright	Watford	1832
Wright	Birmingham	1802
Wright	Oxford	1830
Wright, Charles, & Co.	London	1854–62
Wright, James	London	1881–85
Wright, Robert	London	1825–32
Wright, Thos.	London	1714
Wright, Sam	Kingston	1832
Wynne	Londini	1680–82
Yeomans, Horace	London	1865–70
Yeomans & Son	London	1850–70
Yeomans, T., & Son	London	1850–52
Yeomans, Mrs. E.	London	1853–56
Yeomans, E., & Son	London	1857–64
Yeomans	London	1832–52
Yeomans, Mrs.	London	1853–62
Yeomans, E., & Son	London	1864
Yeomans, Horace	London	1865–70
York	London	1820
York, Chas.	London	1832

APPENDIX VI

A LIST OF SOME AMERICAN AND FOREIGN GUNMAKERS AND DATES OF THEIR WORK

THE system of dating is the same as in the British list. The countries are indicated on broad geographical lines rather than political divisions. This is essential, as Austria, Belgium, Germany and Northern France have all possessed fluctuating boundaries and frontiers have changed from time to time.

Additions and corrections to this list will be welcomed by the author and should be sent to him in care of the publishers.

d'Abezz, Karl	Zurich	1851
Aires, Sebald	Nuremberg	1579
Alberdi, Sebastian	Eibar	1840
Albert, Jos.	Neustadt	1720
Albini, Alberto	Italy	1684
Albrich [Alberich]	Maintz	1770–1810
Aldecoa, Vincente	Eibar	1790
Algora, Gabriel de	Madrid	1749–61
Allarz	St. Etienne	1800
Allbrecht, Heinrich	Darmstadt	1790
Allbright, Henry	Lancaster County U.S.A.	174
Allen & Wheelock	U.S.A.	1837
Allen, C. B., & Falls	Springfield, Mass	1837–40
Allen, Ethan & Thurber	Grafton, Mass .	1837–42
	Norwich, Conn.	1842–47
	Worcester, Mass.	1847–56
Allen, Ethan, & Wheelock	Worcester, Mass.	1856–65
Allen	Utica, U.S.A.	1851
Allevin	Paris	1660–1750
Allin	U.S.A.	1870
Alsop, C. R.	Middletown, Conn.	1861–66
Alt, Georg	Unknown	1666
Altheo, Rodrigo	Barcelona	1800
Alvarez, Diego	Madrid	1775
Alvarez, Melchior	Madrid	1800
Ames, N. P.	Chicopee Falls	1840
Ames Arms Co.	Chicopee Falls Mass	186–
Ames, David	Bridgewater, U.S.A.	1770
Ames, Nathaniel	Boston	1800

Amoskeag Mfg. Co.	Manchester, N.H.	1860
Ancion & Co.	Liège	1851
Andrea, Rudolf	—	1688
Anschutz, R.	Zella	1851
Anschutz	in Suhl	1800
Antis, Wm.	Frederick Town, Penn.	1775
Aparecio, Aquilino	Seville	1800
Aphepotra, Iseixa	Kronstadt	1632
Aqua, Fresca	à Borgia	1694
Argens	Stuttgardt	1770–181–
Arisaka	Japan	1897
Armgert, Michael	Dresden and Leipzig	1588
Arnth	Mergentheim	1800
Arsels	Cagliari	1820
Arzinger, Martin	Unknown	1640
Aston	Middleton, Conn.	1849–52
Ayala, Tomas	Spain	1625
Bacon Arms Co.	Norwich, Conn.	1862–65
Badile, Matteo	Italy	1680
Baeza, Bis Francisco	Madrid	1740–52
Baeza, Matthias	Madrid	1739
Bailey, T.	U.S.A.	1858
Bailey, Thos.	New Orleans	1859–65
Baker & Co.	U.S.A.	1890
Baker, John	Providence, Penn.	1775
Ball & Lamson	Virginia	1864
Baptiste, Miguel	Naples	1790
Barcino, Ignatio	Madrid	1740–60
Barent, Govert.	New Amsterdam	1648
Barguti	Sardinia	1760

Barnes, Thomas	Brookfield, U.S.A.	1800
Baroy, Pierre	Paris	1780
Barrett, "Deacon"	Concord, U.S.A.	1775
Bartholomae	Potsdam	1800
Bartolome	Valladolid	1720
Bastien	France	1720
Batta, Gio.	Brescia	1764
Battazanti, Gio.	Italy	1700
Bauer, George	Lancaster County, U.S.A.	1775
Baver Lorenz	Vienna	1680
Beale	U.S.A.	1858
Beddies, C. F.	Brunswick	1850–60
Behr	Wallenstein	1800
Belen, Juan	Madrid	1684–91
Bell, John	Boston	1746
Bemis, Edmund	Boston, U.S.A.	1746
Bemey	U.S.A.	1850–77
Bensdoffer	Arspach	1750
Bérardier, Philibert	Toulouse	1760
Berech	Germany	1680
Berenger	Paris	1850
Berger	St. Etienne	1851
Bergh	Unknown	1800
Bergstrasser	Unknown	1800
Beringer, B.	Paris	1851
Berlin, A. B., & Isaac	U.S.A.	1775–83
Berlens, Michel	Liège	1790
Berleur, Michael	Unknown	1750
Bernard, L.	Passy	1851
Bernemolin, N.	Liège	1851
Berry, W.	Poughkeepsie, N.Y.	1840–65
Bertonnet	Paris	1851
Bessmer, Henry	Belgium	1854
Bevier	Paris	1668
Bianchi, E.	Gardone	—
Bianco, F.	Italy	1700
Bidwell, Oliver	Connecticut	1800
Bieslinger, Leonhardies	Vienna	1687
Billard	Paris	1800
Bis, Nicholas (1)	Madrid	1699–1726
Bis, Nicholas (2)	Madrid	1724–46
Blackwood, Marmaduke	Philadelphia, U.S.A.	1775
Blake	U.S.A.	1890
Blamer, Hans	Freistritz	—
Blancke	Nauerberg	1851
Bliss & Goodyear	New Haven, Conn.	1865
Blunt & Syms	New York, U.S.A.	1865
Boardlear, Samuel	Boston	1796
Boest, H.	Germany	1569
Boest der Junge	Germany	1569
Bolton, Enoch	Charlestown, U.S.A.	166–
Bonfeau, C.	French	1670
Bongarde, A.	Dusseldorf	1680
Bongarde	France	1700
Bongarde	Dusseldorf	1760
Bongarde	Tours	1780
Bonisolo, Antonio	Italy	1720
Borio	Asti	1820

Bosler	Darmstadt	1750–1800
Bossi, Quiliano	Rome	1616
Botha, J. S. T.	Cape Town, South Africa	1860
Bouillet	Paris and St. Etienne	1715–74
Bourgeois	Paris	1657
Bourne, Wm.	Savannah, Ga.	1865
Boutet	Versailles	1760–1825
Boyd	Montreal, Canada	1860
Braendlin, E. A.	Liège	1867
Brecht	Weimar	1851
Breidl, Jo. Paul	Zeller	1700
Breiter, Hans	Augsburg	1666
Bremeck	Unknown	1800
Brésol	Charleville	1760
Brezol	Caen	1820
Brezollaine	Paris	1800
Briggs, Kneeland	U.S.A.	1890
Bringot	Paris	1802
Brooklyn Arms Co.	Brooklyn, N.Y.	1863–66
Brooks & Brookes	Boston, U.S.A.	1675
Brown	U.S.A.	1895
Bruni	Milan	1660
Brunon, Laine (l'Ainé ?)	Caen	1770
Buck, H. A.	Connecticut, U.S.A.	1880
Buell, E.	Marlborough, Conn.	1810
Buffington	U.S.	1890
Bullard	U.S.	1890
Bunce	U.S.	1890
Burgnier, Hans	Graty	1626
Burnside	U.S.	1856
Busch	Lancaster County, U.S.A.	1775
Bustindui, Augustus	Toledo	1765
Bustindui, Juan Esteban	Eibay	1775
Butler, John	Lancaster, U.S.A.	1775
Butterfield, J. S.	Philadelphia, Pa.	1855–56
Buxbaum, Franz	Unknown	1693
Cæsar, J.	Unknown	1650
Caillovel	Lyons	1672
Calvis	Spandau	1790–1810
Caminelleo, Vitelli	Pistoia	1540
Cani, Ventura	Italian	1650
Cano, Josephe	Madrid	1740–51
Cantero, Manuel	Madrid	1785
Carcano	Italy	1891
Carlat	St. Etienne	1820
Carmingle	Utrecht	1750
Caron, A.	Paris	1851
Carrier et Loy	France	1780
Cartage	France	1750
Caspar, Wilhelm	Gratz	1602
Catane, G. (? Giocatane)	Unknown	1680
Cavil	France	1720
Celaya, Joaquim	Madrid	1749
Cenano, Salvador	Madrid	1762–93

Cegarra, Miguel	Madrid	1760
Chaffee, Reece	U.S.	1885
Chamelot, Delvigne	Switzerland	1872
Chapman, James	Buck County, U.S.A.	1776
Chsâteau à Paris	Paris	1620–90
Chateauvillar, Montigny	Brussels	1849
Chaumette	Paris	1751
Chery	d'Aosta	1820
Christ, Albert	Birmingham, England and U.S.A.	1866
Christian	Vienna	1780
Choderlot	Paris	1660
Cisteron, Figeac	Unknown	1720
Claude, Thomas	Epinal	1623
Claudin, A.	Paris	1840–60
Claus	Halverstadt	1790–1810
Coignet, Pierre	France	1760
Colombo	Italy	1750
Comblain	Paris and Brussels	1835
Cominazzo, Lazarino	Brescia	1600–1780
Comminazzo, Lorenzo (also written Commazzo, Lazaro, Cominaco) (several generations)		
Cone, D. D.	Washington, U.S.A.	1860
Connecticut Arms Co.	Norfolk, Conn., U.S.A.	1862
Contino, Carlo	Italy	1750
Contriner	Vienna	1750
Cookson, John	Boston, Mass.	1727
Cooper, James	Pittsburg	1863
Cooper F. A. Mfg. Co.	Frankford, Phila., Penn.	1858–65
Cordier	France	1880
Coster, Cornelius	Germany	1790–1810
Cotel, Bartholomeo	Italy	1700–40
Cousin	Rambouillet	1750
Cowell, Ebenezer	Allentown, U.S.A.	1775–85
Cowell, Joseph	Boston, Mass.	1745
Craft, Hans	Gratz	1570
Crausse	Harzburg	1800
Clett (Klett) Joh. Paul	Sakburg	1657
Conroy	U.S.	1885
Coop, Theo.	Utrecht	1760
Coster, Cornel	Utrecht	1650
Crewze	Harzburg	1800
Dafte, I.	Germany (London, 1680)	1790
Dallam, Richard	Maryland, U.S.A.	1775
Dandoy, Maillard Lucq	Maubeuge	1851
Danner, Wolf	Nuremberg	1552
Danson, Simon	Unknown	1650
Danzlin	Nuremberg	1590
Darsch, H.	Gratz	1630
Davenport	U.S.	1894
Dax, Leon George	Germany	1690
Dax, George	Munich	1725–50
Day	U.S.A.	1864
Debin, Hubert	Amsterdam	1820
Deckard, Jacob	Philadelphia	1732
Deckard (Deckhard), T.	Lancaster	1750–70
De Foullois	Paris	1660
Deiler, Hans Heinrich	Frankfort	1663
Delahari	Maestricht	1680
Delin, H.	Freyburg	1700
Delvigne	Paris	1828
Demondion	Paris	1831
De Nancy	Paris	1660
De Neve Maisons	Paris	1660
De Nousse	Liège	1851
Dentzl, Hans	Nuremberg	1572
De Reiner, Michael	Lancaster, Penn. U.S.A.	1775
Deringer, Henry	Philadelphia	1820–40
Deringer, Henry	Pennsylvania	1780
Des Granges	Paris	1660
Des Trois Maisons	Paris	1660
Deterer, Adam	Lancaster, Penn., U.S.A.	1740
Devillers,	Liège	1740
Devilliers	Liège	1820
Devisme	Paris	1815
Dewyck, Jean	Utrecht	1640
Dexter	U.S.	1890
Dichore, A.	Giessen, Hesse	1851
Didier, Abel F.	France (?)	1644–99
Dietrich, Andr.	Holland and Passau	1550
Dike	Bridgwater, U.S.A.	1775
Dison, S.	Germany	1770–1800
Dom, Franz	Lorenz	1700
Domineo, Joseph	Italy	1750
Donahy, J.	Amsterdam	1815
Donner, Casper	Gratz	1601
Dorchester	U.S.A.	1633–37
Doutrewe, F. J.	Liège	1851
Dransmiller	Dresden	1600
Dreyse & Collenbusch	Sommerda, Germany	1840–60
Drippard	Lancaster, Penn., U.S.A.	1780
Druart	Paris	1660
Drurv, Mat.	Unknown	1638
Dubois	France	1820
Dubois	Paris	1750
Duclos	Paris	1851
Dunwiche	Chester County, Penn., U.S.A.	1770
Dupont	Paris	1760
Durlachs	Unknown	1750
Durie	Paris	1660
Durnl, Erasmus	Unknown	1588
Durst	U.S.	1885
Eagle F. A. Co.	New York	1863
Earl, Thomas	Leicester, U.S.A.	1776
Ebert	Sondershausen	1790–1810
Echl (three generations of this name)	Berlin	1750–1825

Eckhard, Leopold	Prague	1780–18 (?)
Eggler, Lorenz	Unknown	1653
Eliot	U.S.	1860
Ellepock, Rochus	Strauwing	1720
Elliot	U.S.	1890
Ells	U.S.A.	1857
Ely, Martin	Springfield, U.S.A.	1775
Emmes, Nathaniel	Boston	1796–1825
Enzinger, Mich. Speckle	Baden	1650
Ertl, Michel	Lietzen	1571
Escalante, Basileo	Madrid	1800
Esquibel, Diego	Spain	1719
Esquivel, Diego	Madrid	1732
Evans Pat. Arms Co.	U.S.A.	1868
Eysenberger, J.	Austria	1684–86
Eysenberger, Stephen	Austria	1685–96
Fachter	Liège	1790
Fadino, Bartoy	Italy	1640
Falisse & Rapman	Liège	1851
Falley, Richard	Westfield, Mass.	1775
Farnese	Florence	1709
Fatou	Paris	1780–1830
Fauth	Gratz	1800
Fernandes, Juan	Madrid	1726
Fernandez	Madrid	1676
Fernandez, Pedro	Madrid	1785
Ferre, Joel	Leacock, Lancs., Penn.	1750
Ferree, Joel and Jacob	Lancaster, Penn	1775–78
Finch, Joseph	New York	1800
Fischer, Martin	Suhl	1790–1810
Fischer, C. A.	Lubeck	1851
Fitch, John	New Jersey	1771–75
F.L.F.H.V.Z.Z.	Unknown	16th cent.
Flobert	Paris	1850
Flock, Jan.	Holland	1680–1720
Flock, W.	Amsterdam	1750
Florentino, Pietro	Brescia (lock maker)	1720
Florentino, Pietro	Brescia	1650
Fogerty	U.S.	1889
Follecht	Lancaster, Penn.	1775
Fondegrift	Penn.	1775
Fontenan	Nantes	1851
Fondesmith	Lancaster, Penn	1775
Ford	U.S.	1890
Forehand	U.S.	1870 to date
Foster, G.	Taunton, Mass.	1849
Foulke, Adam Easton	Allentown, Peen.	1775
Francino, Antonio	Brescia	1700
Francino, Gio. Bat.	Brescia	1640–80
Franck	Lancaster, Penn.	1775
Franklin	U.S.	1890
Franz, L. Gabrie	Vienna	1684–1714
Frappier	Paris	1790
Freconnet, Roule	St. Etienne	1812
Freeman	U.S.A.	1862
Freeman	U.S.	1890
Freidler	Ulm	1790–1810
Freieisen, Hans (Meister)	Austria	1566

Fremmery	Berlin	1790–1810
French, Thomas	Canton, Mass.	1800–1862
Freund, Christoph Wilhelm	Furstenau	1790–1810
Freund, Carl	Furstenau	1790–1810
Frey, Hans	Augsburg	1577
Frislera, Cristobal	Ricla	1620
Fromery	Berlin	1730
Frorrer	Winterthur	1740
Frost, Gideon	Mass., U.S.A.	1775
Frucworth, Joseph	Forchenstein	1800
Gabriel	Paris	1705
Galand	Paris	1868
Gallagher	U.S.A.	1863
Garatto, Dian	Italy	1680
Garcia, Domingo	Unknown	1640
Garcia, Francisco A.	Madrid	1790
Gardiner	U.S.	1875
Gardner	U.S. (Colt Factory)	1870–90
Garret	Paris	1660
Garret, Herman	Boston	1650
Gaspard	Lancaster, Penn.	1775
Gastinne-Rennette	Paris	1840 to date
Gatnay	Liège	1740
Gaviola, Juan Andra	Eibar	1790
Gazez	Paris	1790
Gehrmann, T.	Berlin	1851
Geiger	New York	1849
Georg, J.	Stuttgardt	1790–1820
Gerrish, John	Boston	1709
Gevelot-Lemaire	Paris	1851
G. F. P.	Unknown	1580
Gia	Paris	1750
Gibbs	U.S.A.	1861
Gibenhan	Warsaw	1783
Gilbert, Daniel	Brookfield, Mass.	1750–182(?)
Gingerien, Henry	Lancaster, Penn.	1775
Giocatane	Italy	1750
Girard, P.	France	1780
Girard et Cie	Paris	1810
Giverde	Strasburg	1780
Glasonder	Utrecht	1690
Gleichauf, B.	Bochenheim	1851
Globitzer, Peter	Gratz	1612
Goddet, A.	Paris	1851
Goell, Jorg.	Artzburg	1649
Goffart	Germany	1812
Golcher, John	Easton, Penn.	1775
Gomez, Antonio	Madrid	1762
Gonter, Peter	Lancaster, Penn.	1775
Gorgas, T. C.	Ballenstadt	1790–1810
Gottschalk	Ballenstadt	1790–1810
Gotz	Mathias, Nuremberg	1554
Gouger	Pennsylvania	1775
Græff, Wm.	Reading, Penn.	1761
Graffe	Paris	1660
Greene	U.S.A.	1856
Gregory, Richard	Boston	1727
Grenet, Jean	Perleberg	1790–1810

Gresheim	Lancaster, Penn.	1775
Grevin, Guillaume	Liège	1568
Grohnwald, C. E.	Cologne	1860
Gryzbowshi, H.	Potsdam	1851
Guillam, Benjamin	Mass.	1775
Guny	Warsaw	1800
Guter	Nuremberg	1560
Gutierrez	Seville	1820
Gutzinger, Johann	Germany	1677
H. C. R.	Unknown	1600
H. F.	Unknown	1630
H. F.	Unknown	1619
H. K.	Unknown	1600
H. V.	Unknown	1656
Hahn	New York	1870
Hall	U. S. A.	1816
Halthueber, Jacob	Gratz	1650
Hamerl, Jacob	Austria	1630–52
Hamerl, Joseph	Vienna	1600–1725
Hamerl, Wolf	Austria	1648
Hamerle, Tamas Tanman	Austria	1680
Hamilton	U.S.	1890 to date
Hammerl, Thos. in	Zurich	1790
Hammond	Conn., U.S.A.	1864
Hampden	U.S.	1890
Hans, A. P.	Liège	1886–89
Hansch, Joseph	Nuremberg	1720
Hansierg	Voss	1699
Harg	Cranach	1790–1810
Harrington & Richardson	U.S.	1880 to date
Harris, Isaac	Maryland	1775
Hart, B. F.	New York	1870
Hauer	Wurzburg	1700
Hauer, Joseph	Nuremberg	1618
Hauser	Wurtzburg	1790–1810
Heber	Carlsbad	1790–1810
Heinlein, C. V.	Bamberg, Bav.	1851
Heischaupe	Ulm	1750
Heizch, J. G.	Neustadt	1780
Helmer, Franz	Vienna	1720
Hench	Lancaster, Mass.	1775
Henry, Wm.	Lancaster, Phil.	1750
Henry, J. J.	Philadelphia	1812
Henry, Wm.	Nazareth	1808
Hepburn	U.S.	1880
Herbst, T.	Nuremberg	1617
Hermans, Jean	Unknown	1800
Hermann	Liège	1815
Hermandez, Francisco	Cordoba	1620
Herder, Sebald (the elder)	Germany	1563
Herder, S.	Germany	1584
Herraez, Andrea	Cointra	1590–1620
Hesolt, Zacharias	Nuremberg	1567
Heurteloup	Belgium	1838
Heusenberger, Jos.	Neustadt	1620
Hill, Thomas	Carlotta, Vermont	1790–1810
Hinds, John	Boston	1745
Hiquet, Cleode	Liège	1690
Hirder	Nuremberg	1558
Hirsch, Christ	Vienna	1790–1810
Hoard Armoury Co.	Watertown, N.Y.	1862
Hoch, George	Unknown	1654
Hoffman, Johan Georg	Unknown	1610
Hofkircher, Peter	Austria	1539
Hofman, Cristof	Zurich	1720
Hofman, George	Pressburg	1770
Hofman, Tobias	Unknown	1658–64
Hofstatter (Hochstotter)	Hier	1699
Hohehelb, C. L.	Austria	1661
Homiller, B.	Paris	1847–51
Hopkins & Allen	U.S.	1865 to date
Horn, Stephen	Easton	1775
Hotchkiss	U.S.A.	1869
Howard Bros.	Whitneyville, Conn.	1865
Huart, M.	Verdun	1750
Hueber, Hans	Hollenberg	1588
Hunt	U.S.	1890
Husharet, Teitrich	Olmitz	1700
Hyde, Goodrich	New Orleans	1780–1850
Hyrsbach, Bernard	Nuremberg	1527
Hyslop, R.	New York	1850
I. G. H. (mark of Koch)	Vienna	1650
I. K.	Germany	1629
I. P.	Germany	1595
I. and W.	Unknown	1580
Isch, Christian	Lancaster, Penn., U.S.A.	1775
Ithaca Gun Co.	U.S.	1873 to date
Iver Johnson	U.S.	1880 to date
Jaiedtel	Vienna	1790–1810
Jameau, D.	France	1650
Janker	Crambach	1790–1810
Jao, Baptiste	Lisbon	1816
Jaquet	Geneva	1820
Jarre	Paris	1810
Jasinto, Jaumandrew (L)	Manresa, Spain	1739
Jenks	U.S.A.	1844–47
Jenks, Stephen	Pawtucket	1775
Jensen, N. S.	Copenhagen	1851
Joaquin	Spain	1750
Johandi	Brescia	1780
Johnson, William	Worcester, Mass.	1787
Johnson	Middleton, U.S.A.	1841
Joneppe, M.	Lorgio Formi, Sardinia	1780
Jones, Robert	Lancaster, Penn.	1775
Jones, Charles	Lancaster, Penn.	1775
Jones	U.S.A.	1846
Joslyn, B. F.	U.S.A.	1858–70
Jovin, Pere et Fils	St. Etienne	1720
Kalb, G.	Germany	1780–1810
Kappe, H. H.	Germany	1780–1810

Kascheline, Peter	Northampton, U.S.A.	1775
Kauffmann	Germany	1780–1810
Kayser, George	Vienna	1780–1810
Keeley, Mathias and Sebastian	Pennsylvania	1775
Kehl, J. C.	Berlin	1851
Keiser, Georg	Vienna	1700
Keiser, Georg (I)	Vienna	1647
Keiser, Georg (II)	Vienna died	1737 1785
Keiser (III)	Forchtenstein	1820
Kelton	U.S.	1883
Kemmerer	Thorn	1780–1810
Kempton, Ephraim	Salem and Boston	1677
Kendal	Windsor, U.S.A.	1850
Kennedy	U.S.	1870
Kerlin, John	Penn., U.S.A.	1775
Kesser, Math.	Unknown	1676
Khadl, Lorenz	Gratz	1583–95
Khamer, Valtham	Unknown	1554
Kheller, Hs. Jk.	Salsburg	1684–99
Kheller, Leonard	Salsburg	1633–58
Khnoll, Adam	Austria	1696–99
Kinder	Penn., U.S.A.	1775
Kirk	U.S.	1863
Klein	New York	1849
Kleinschmidt	Wisterberg	1780–1810
Kleist, Daniel	Bethlehem, Penn.	1780
Klet, Sigmund	Gratz	1652
Klett, J. C.	Potsdam	1780–1810
Klett, Stephen	Suhl	1586
Klett, Conrad (Cornel)	Salzburg	1657
Klett, Joh Paul	Salzburg	1658
Knoot, Jan	Utrecht	1680
Knopf	Salzthal	1780–1810
Koch, Jacob (mark I. G. H.)	Vienna	1650
Koch, Nicholas	Vienna	1700
Koint, Georg	Germany	1780–1810
Kolbe	Germany	1760
Kollner, Gaspard	Vienna	1450
Kolter, Augustinus	Germany	1616
Konig, C. G.	Coburg	1851
Koop, Theodorus	Utrecht	1705
Kotter, Augustus	Nuremberg	1520
Krawimsky	Posen	1780–1810
Krews, Andrea	Klagenfurt	1588–1600
Krews, Christof	Leitzen	1590
Krnka	Vienna	1887
Kruger	Ratibor	1780–1810
Krupp, F.	Essen	1851
Kuchenreuter, B. S.	Regensburg	1700
Kuchenreuter, J. A.	Mark Z. Regensburg	1680
Kuchenreuter, J. Chris.	Regensburg	1740
Kuchenreuter, Johm, Andreas	Regensburg	1740–50
Kuchenreuter, Joh. And.	Regensburg	1800
Kuchenreuter, T. G.	Regensburg, Bavaria	1851
Kuhfuss, Georg	Nuremberg	1600
La Chaise	Paris	1560
La Cousture	Paris	1660
La Fonteyne, Muentain	Mourgues	1640
La Grere	Paris	1851
Laguisano	Madrid and Seville	1596
Lamane	Paris	1750
La Marre	Paris	1660
Lambert dit Biron	Paris	1770–1840
Lambleux	Paris	1660
Lammerer, T.	Cranach	1790–1810
Langrenus, Michel	Italy	1640
Languedon	Paris	1720
Lansieux & Dewaller	Liège	1850–60
Lantos, Luis	Madrid	1700–30
La Plene	Maastricht	1650
Lapiene, De	Paris	1650
Lardinois, N. C.	Liège	1851
La Roche	Paris	1700
Laroche	Paris	1790
Larrosa	Seville	1791–1841
Larsen, H.	Drammen, Norway	1842
Lasonder, G.	Utrecht	1750
Latouche, Guntner	Paris	1870
Laurent, Valet	Paris	1660
Lazarino, Comminazo	Gardone, Brescia died 1696 in Gardone	1640–96
Lazarino, Comminazo Angelo	—	1681
Lazarino, E.	Brescia	1770–80
Lazaro, Lazarino	Brescia	1640
Lazdendecher, George	Allentown, Penn.	1780
Leader, Richard	Boston	1646
Leavitt	Hartford, Conn., U.S.A.	1837–18(?)
Le Clere, Jean	Paris	1730
Le Clere, G. B.	Turin	1819
Le Clere, Nicholas	Paris	1780
Le Conte	Paris	1650–60
Ledent, M.	Liège	1851
Le faucheux	Paris	1820–71
Lee, Burton	U.S.A.	1886
Leger, Hieronimus	Unknown	1632
Lehner, Tohann	Unknown	1700
Leitner, Wolfgang	Ischl	1660
Leiz	Vienna	1620
Le Larain	Valence	1660
Leman, H. F.	Lancaster, Penn.	1740
Leman, Peter	Lancaster, Penn.	1740
Lemani	Paris	1740
Le Mat	Paris	1835–71
Le Miegam, C.	Paris	1780
Lennard	Lancaster, Penn.	1770
Lenormand	Paris	1815
Leotien, A.	Paris	1725–50
Le Page	Liège	1851
Le Page, Faure	Paris	1865 to date
Le Page, Henri	Paris	1822–42
Le Page, Jean	Paris	1779–1822
Le Page, Pierre	Paris	1743–49
Le Page, Moutier	Paris	1842–65
Leroy, Julien	Paris	1840

Letourneau, le Jeune	Angers	1760
Le Tourneau	Angers	1720
Lewis, N.	Troy, U. S.A.	1800
Libean, V. G. W.	New Orleans	1847
Libeda	Prague	1800
Linck, Marius	Prague	1660
Lindner	U.S.A.	1861
Lindner, Daniel	Dresden	1700
Lionville	Paris	1700
Lippe, van der	Stettin	1790–1810
Lippert, C.	Cothen	1790–1810
Loder	Lancaster, Penn.	1770
Lombard	Paris	1720
Lopez, Francisco	Madrid	1671–73
Lopez, Francisco	Madrid	1800
Lopez, Gregorio	Madrid	1796
Lopez, Gregorio	Madrid	1788–92
Lopez, Jose	Madrid	1750
Lopez, Valentino	Seville	1780
Lorenzohn	Innsbruck	1680
Loron	Paris	1835
Louroux, Johann	Maestricht	1750
Lubosch, H. H.	Prague	1700
Ludlich	Posen	1851
Lunderschloss	Austria	1835
Maetl, Mathew	Austria	1638
Macuarte, Felipe	Madrid	1555–99
Macuarte, Pedro (brother of Simon)	Madrid	1519–40
Macuarte, Simon	Madrid	1519–40
Macuarte, Simon (II)	Madrid	1555–99
Maestre	France	1720
Maierhoffer, Thomas	Voitsberg	1578
Makl, Valentin	Copenhagen	1750
Malherb	Liège	1837
Manani, Pietro	Brescia	1750
Mangeot	Paris	1835
Mangwet, Daniel	Ugraun	1701
Mann, Michel	Uhlenberg	1630
Mantz, Ulrich	Braunschweig	1720
Marcelnir	Vienna	1750
Marchal, Martin	Spain	1780
Mariette	France	1820
Markloff, H. Nicholas	Hanau	1680
Marlin	U.S.A.	1880
Marquis	Paris	1760–1810
Marston, Phœnix Wm.	New York	1858
Marter, Damien	Bonn	1790–1810
Martinez, Alonso	Madrid	1699–1725
Martinez, Ramon	Madrid	1790
Martinoni, P.	Naples	1730
Mascon	Paris	1660
Mason, W.	U.S.	1874
Massachusett Arms Co.	Chicopee Falls, U.S.A.	1845
Masson, Alexandre	Paris	1660
Masson, Jean	Paris	1660
Massone, Giovanni	Turin	1830
Mateo, Hilario	Madrid	1792
Mathe	Mannheim	1790–1810
Mathien, L.	Paris	1851
Matl, Mathias	Austria	1577
Matl, Matias	Austria	1652
Matson, Thomas	Boston	1658–82
Matzer, Andrea	Austria	1665–77
Mauser	Germany	1876
Mayor, Felix	Vienna	1750
May	Manheim	1790–1810
Mayer	France	1660
Mayes, Ch.	Lancaster	1770
Maynard	U.S.A.	1854
Mazellier	Paris	1730
Mazza	Naples	1830
McClean	U.S.	1900
Medecino, Andrea	Brescia	1670
Meier, Felix	Vienna	1700
Meigs	U.S.	1870
Mendtel, Johann	Prague	1620
Merill, T. M.	Baltimore	1858–61
Merrit, John	Boston	1789–98
Messer, Jak	Unknown	1699
Messersmith	Maryland	1776
Metola, Juande	Seville	1620
Meyer	Innsbruck	1851
Meylan, Martin	Lancaster	1719
Micerguillo	Madrid	1560
Michel	Switzerland	1790
Micheloni	Milan	1851
Migona	Pistoja	1750
Miles	U.S.	1895
Miles, Thomas	Pennsylvania	1775
Milich, Johan	Munich	1592
Millbenz	U.S.A.	1825
Miller, Mathias	Easton, Penn.	1775
Mills	Harrodsburg, Kentucky	1790
Minich, M.	Liège	1760
Minick, M.	Flanders	1730
Minié	Liège	1850
Miruena, Juan	Seville	1620
Mitenegger, Sebastian	Gratz	1635
Moll, John	Allentown, Penn.	1775
Montaign	Metz	1740
Montalembert	Paris	1776
Montarges, Carlos	Bordeaux	1778
Montarges, Carlos	Madrid	1785
Montaur	Geneva	1794
Montiguy & Fusnot	France	1851
Moore, Abraham	Coventry, Penn.	1775
Moore, Daniel	Brooklyn	1862
Moore, Pat. F. A. Co.	Brooklyn, N.Y.	1863
Moore, Daniel	U.S.	1860–70
Moore, Wm.	Windsor, Conn.	1860
Mora, C. A.	Spain	1586
Morino	Spain	1745
Morse	U.S.A.	1861
Motto, Gieronimo	Italy	1750
Movet	Charleville	1780–1800
Mowry, Jas. D.	Norwich, Conn.	1860–64
Muller	Bemberg	1790–1810
Muller	Steinau	1790–1810
Muller	Halverstadt	1750
Mullins	U.S.	1890
Muniz, F.	Spain	1810

Munoz, Pedro	Seville	1620
Murva	Spain	1810
Mutveiza	Toledo	1751
M. W.	Unknown	1580
Nantz	Paris	1660
National Arms Co.	Brooklyn, N.Y.	1860
Naudin	Paris	1660
Naumann	Cassel	1790–1810
Navarro, Antonio	Toledo	1780
Negroli, Filippo	Milan	1525
Negroni, H.	Florence	1794
Neireiter	Salzburg	1675
Neisse	Unknown	1810
Nepperan F. A. Co.	Yonkers, N.Y.	1859
Neureter	Salzburg	1790–1810
Neureter, Caspar	Prague	1670
Neureiter, Lorenz	Prague	1700
Newhardt, Jacob	Allentown, Penn.	1780
Newhardt, Peter	Allentown, Penn.	1780
Nicholas	Madrid	1693
Niquet, Claude	Liège	1700–30
Niquet, Le Jeune	Limoges	1710
Niquet	Liège	1770
Noel	Paris	1860
Nœvecœur	France	1750
Noisin	Geneva	1750
Nordmann	Berlin	1790–1810
North Simeon	Berlin, Conn.	1800
Nusbaum, Matias Vincenti	Breslau	1720
Nuterisch, C.	Vienna	1740
Oberholzer, Christian	Lancaster, Penn.	1775
Oberlander	Nuremberg	1660–1714
Odlin, John	Boston	1670–85
Ohle, E. F.	Breslau	1815
Oit, M.	Wiesbaden	1790–1810
Oliviera, Joaquin Jose	Lisbon	1799
Ontner	Germany	1680
Ontner, Bernard	Germany	1630
Onuterisch	Vienna	1720
Opy, Jacobus van	Antwerp	1600
Orr, Robert	Springfield	1795
Orr, Hugh	Bridgwater	1737–98
Ortiz, Augustin	Madrid	1761
Otto	Brandenburg	1790–1810
Paczelt, Stanislaus	Prague	1738
Palacios, Pedro	Soria	1620
Paliard	St. Etienne	1830
Palm, Jacob	Lancaster, U.S.A.)	1768
Palmer, W. R.	New York	1851
Paratici, Batistini	Florence	1750
Parker, Snow	Meriden, Conn.	1860
Par le Borguignon	Paris	1660
Patnam	U.S.	1895
Pauer, Lorenz	Vienna	1720
Pauer, Joseph	Vienna	1800
Pauly	Geneva and Paris	1808–30
Peabody, H. O.	U.S.A.	1862
Pearson, James	Penn., U.S.A.	1775
Pechocker, Killian	Unknown	1554
Peigne, V. T.	Northern France	1851
Peit(b)let, Hans	Unknown	1646
Penel a la Place	Paris	1750
Penhallow, Capt. John	Boston	1726
Perin	Poitiers	1820
Perkins, James Luke and Rufus	Bridgwater	1800
Perry	Newark, N.J.	1855
Penzneter	Vienna	1770
Pesi, Siontia	Italy	1700
Petrini	Florence	1650
Pettingill	U.S.A.	1850–58
Philibert, Berardier	Toulouse	1760
Phips, James	Kennebec River	1650
Pienon	Paris	1720
Piermair, T.	Riedt	1780
Pigny	Paris	1716–43
Pim	Boston	1722
Pirmet	Paris	1770
Pisinardo, Benedetto	Italy	1737
Pising	Unknown	1580
Pistor, G. and W.	Schmalkalden, Germany	1851
Pitcher	U.S.	1885
Plant Mfg. Co.	New Haven, Conn.	1863
Plenovitch, Georg	Allrecht	1695
Plescher, Georg	Augsburg	1663–77
Plomdeur	Liège	1851
Poel, Vander	Albany, N.Y.	1740
Poeta, Geo.	Brescia	1740
Pohle, Gottfried	Bremen	1760
Poitevin, l'Aime	Paris	1750
Polz	Carlsbad	1790–1810
Pomeroy, Ebenezer	Northampton	1669–1754
Pomeroy, Elty	Pomeroy, Boston	1630–71
Pomeroy, Eldad	Boston	1630–62
Pomeroy, Lemuel	Northampton, Pittsfield	1790–1840
Pomeroy, Medad	Northampton	1659–1716
Pomeroy, Seth	Mass., U.S.A.	1775
Pomeroy, General Seth	Northampton	1706–77
Pond, L. W.	Worcester, Mass.	1863
Pons, Eudal	Toledo	1770–1800
Ponsin	France	1715
Pornisch, Orban	Wolfsberg	1577
Poschl, Michael	Unknown	1655
Poser, Paul	Unknown	1680
Postindol	Spezzia	1750
Potzi	Carlsbad	1790–1810
P.O.V.G.	Unknown	1590
Prahl, Lewis	Philadelphia	1775
Pramb, Michael	Weischewer	1600
Prantner, Andrea	Warsaw	1675
Prebes	Paris	1660
Prelat	Paris	1824–51
Premb, Hans	Unknown	1664
Prescott	U.S.A.	1860
Presselmeyer	Vienna	1790–1810

Preus	Nuremberg	1570
Pringer, Sebastian	Augsburg	1665
Pringle, John	Penn., U.S.A.	1775
Prolich, Joseph	Bamberg	1840
Provice	à Sedan	1730
Puechgraber, Hans Christ	Gratz	1663–81
Putnam, Enoch	Granby, Mass.	1775
P. V.	Unknown	1678
Quade	Vienna	1790–1810
Quass, Jacob	Indenberg	1560–79
Radfang, George	Lancaster	1775
Rasch	Brunswick	1790–1810
Romirez, Pedro	Madrid	1765
Rathberger, Gregori	Hornberg	1766
Raymond, Robitaille	New Orleans	1861
Raymond & Robitaille	U.S.A.	1856
Read, Robert	Chesterton, Maryland	1775
Reck, George	Austria	1769–82
Rechold, T. And.	Dorp	1790–1810
Recknagel, Caspar	Luneburg	1632
Reichert, Manfried	Germany	1790–1810
Reidt, Hans	Weiz	1633
Reigel	Zweibrucken	1750
Reimer, Heinrich (HR)	Germany	1600
Rein	New York	1870
Reinhardt, Hans	Nuremberg	1565
Reisinger, Leopold	Gratz	1650
Reisner	Nuremberg	1561
Reitz, Claus	Suhl	1586
Remington	U.S.A.	1864
Remington, Beals	U.S.	1858
Remington-Rider	U.S.	1859
Reme, David	Germany	1790–1810
Rener, C.	Germany	1790–1810
Renier, H.	Paris	1780
Renier, I.	Paris	1750
Renner, Sebald	Nuremberg	1554
Resch, T. S.	Austria	1684–88
Rewer	Dresden	1707–97
Richards, C. B.	U.S.	1874
Richs, Thos.	Boston	1677
Riddell	Lancaster	1770
Ripole, S. A., Factory	Spain	1780
Rischer, Joh	Spandan	1790–1810
Rittenhouse, Benjamin	Norrington, Pennsylvania	1775
Rives	Paris	1780
Robbins & Lamson	Windsor, Vermont, U.S.A.	1851
Robert	Paris	1831
Robins & Lawrence	Windsor, U.S.A.	1852
Robinson, E.	New York	1862
Rodrigues, Carlos	Madrid	1785
Roeser, Mathew and Peter	Lancaster	1744
Roesser, Mathew	Lancaster, Pa.	1739
Rogers & Spencer	Utica, U.S.A.	1863
Ronchard, Siauve	St. Etienne	1851
Root, E. K.	U.S.	1855–70
Roper	U.S.	1866–95
Roscher, T.	Carlsbad	1790–1810
Rosner, Hans	Nuremberg	1550
Rosner, Peter	Nuremberg	1557
Rosner, Gorg	Nuremberg	1559
Rosner, Linhardt	Nuremberg	1543
Rossner, Hans	Nuremberg	1557–58
Rossner, Jacob	Nuremberg	1650
Rouma, L.	Liège	1770
Rouse, C.	Lyons	1660
Ruef, Simon	Unknown	1689
Russell	U.S.	1890
Saeter, Peter	Lemgo, Lippe-Detmold	1790–181
Sahagorn (Sahagun)	Spain	1680
Sahlterer, Phil	Austria	1664–81
Salado	Madrid	1620
Sanerbrez, L.	Zella	1851
San Martin, Benito	Madrid	1750
Sanner, von Egid	Nuremberg	1578
Santos	Valencia	1691
Santos, Juan	Madrid	1700
Santos, Luis	Madrid	died 1721
Santos, Martin	Madrid	1760
Santos, Sebastian	Madrid	1752–62
Sarmer, Georg	Nuremberg	1579
Savage, R. F. A.	Middletown, Conn.	1860
Savage, E.	Middletown, Conn.	1856–59
Schackan	Bamberg	1790–1810
Schaller, C.	Suhl	1851
Schamal, F.	Prague, Austria	1851
Schedel	Stuttgardt	1790–1810
Scherb, Hans	Nuremberg	1572
Scheiner, Sig Karl	Unknown	1656
Schilling	Suhl	1851
Schirrman	Basel	1790–1810
Schlacher, Siegmund	Gratz and Neustadt	1560–79
Schmidt, J.	Mecklenberg	1851
Schmidt-Rubin	Switzerland	1889
Schneeudjet	Lahr, Hungary	1841
Schneeloch	Brooklyn, U.S.A.	1860
Schneevoight	Baden	1790–1810
Schnepz, Adam	Germany	1670
Schnidt, Christof	Lietzen	1578–90
Schnidt, Hans	Verlach	1634
Schnitzler, Martinus	Unknown	1559
Schofield	U.S.	1870
Schorer	Pennsylvanvia	1780
Schot, Hans	Unknown	1569
Schramur	Zelle	1790–1810
Schreiber	Halle	1760–69
Schreidt, John	Reading, U.S.	1758
Schubarth, G. D.	Providence, N.Y.	1860
Schulhof	Vienna	1886
Schulze, Fr.	Breslau	1790–1810
Scioli, Stefano	Italy	1680

Scott & Triplett	Kentucky, U.S.A.	1864
Segmont	Klette	1650
Seitel, Joham	Unknown	1704
Seidl, Georg	Austria	1604
Senger, J.	Vienna	1800
Sever, Joseph Shubabel	Framingham, U.S.	1775
Seward, Benjamin	Boston	1796–1803
Sewerin	Nuremberg	1590
Sharp	U.S.A.	1848–60
Sharp & Hanlim	U.S.A.	1863
Shattuck Arms Co.	Hatfield, U.S.A.	1860
Shaw	U.S.A.	1775
Shaw, Joshua	Bordentown, N.Y.	1800
Sheffield, Jeremiah	Rhode Island	1775
Sherman, Nathaniel	Boston	1692
Siæns, E. G.	Germany	1670
Siebenbrunner, Jo.	Gratz	1789
Silva, da, Joa	Lisbon	1799
Simonin	Laneville, France	1627
Slocum	Brooklyn	1863
Slotter & Co.	Philadelphia	1840
Small, John	Vincennes	1800
Smith, Antony	Bethlehem	1780
Smith, Jeremiah	Lime Rock	1770
Smith, Johnston	Pennsylvania	1780
Smith & Pecare	New York	1851
Smith & Wesson	U.S.A.	1849 to date
Sneider	Lancaster	1775
Sodder, Daniel	Brussels	1630
Sofranti	Florence	1720
Soler, Isidro	Madrid, Spain	1790
Soler, Manuel	Madrid	1800
Solett, Francis	New Amsterdam	1656
Soll, G.	German	1750
Sommer, Ich.	Bamberg	1685
Sommer, Zach	Germany	1699–1714
Soto, de, Juan	Madrid	1783
Spaldeck	Vienna	1790–1810
Speger, Facka	Holland	1750
Spencer	U.S.A.	1860
Spindler, Simon	Radhersberg	1759
Spitzef	New Market, U.S.	1780
Sporer	U.S.	1880
Springfield Arms Co.	U.S.A.	1851
Stachl, Hans	Unknown	1554
Stack	Germany	1790–1810
Standard American Tool Co.	Newark, N.Y.	1864
Stanyman, Steph	Weiz	1553
Stark	Vienna	1790–1810
Starr	Lancaster	1780
Starr Arms Co.	New York	1856
Starr, Nathan	Middletown, Conn.	1793
Steingastner	Prague	1720
Stephenson-Porter	U.S.A.	1851–54
Sterewith	Maryland	1775
Stern(u)ber, Mich.	Austria	1664
Stetson	U.S.	1870
Steven	Rotterdam	1863
Stevens	Chicopee Falls, U.S.A.	1865
Stiffter, Johann	Prague	1682
Stillman	U.S.	1873
Stillman, Ethan	Brookfield, Conn.	1800
Stockl	Neustadt	1790
Stockl, Johan	Neutsadt	1700
Stockman, Stephen	Potsdam	1780
Stoffner, Jacob	Gratz	1650
Stohl, Hans	Unknown	1552
Stomatti, G.	Florence	1739
Stoper, Matnias	Vienna	1745
Stopler	Nuremberg	1590
Storkhe, Andrea	Austria	1664–86
Stornatti	Spain and Naples	1580
Strangle	Switzerland	1790
Strauss, Hans	Nuremberg	1560–61
Streber, Hans	Nuremberg	1564
Streitl, Martin L.	Anspach	1680–91
Strelttenberger, Martin	Unknown	1684–88
Stunpf, Hans Jacob	Germany	1682
Sutil, Manuel	Astorga and Madrid	1743
S. V. L.	Suhl	1700
T.	Unknown	1590
T. A. M.	Unknown	1650
Tanquy	Paris	1730
Tanner	Cothen	1790–1810
Tanner, C. D.	Hanover	1851
Targarona, Francisco	Madrid	1788–1792
Teff, George	Rhode Island	1775
Tentenberg, L.	Huesten, Germany	1851
Tezenas	Laione	1810
Theiss	Nuremberg	1790–1810
Thomas	Paris	1850
Thomas, Claude	Epinal	1623
Thomson, N.	Rotterdam	1780
Thone	Amsterdam	1770
Thonet, S.	Liège	1851
Thueringer, F. T.	Meissen, Saxony	1851
Thuer, F. A.	U.S.	1868
Thuraine et Hollandois	Paris	1666–80
Thurber, Allen	U.S.A.	1837
Tilemann, Sch. Ulrich	Marburg	1676
Tinlot, M.	Liège	1851
Toll	Sahl	1790–1810
Tomas	Spain	1850
Tourey, H.	Liège	1851
Town, Benjamin	Penn., U.S.	1775
T. P. C. D. E. G. B.	Unknown	1702
Trapmann, F.	Germany	1852
Triplett & Scott	Meriden, U.S.A.	1864
Tryon	Philadelphia	1811
Turnbull	New Orleans	1885
Tyler, John	Penn., U.S.A.	1780
Uhl, Tobias	Unknown	1655
Ulrich	Eberndory	1790–1810
Ulrich, F.	Schwartzenberg	1860
Utter	Warsaw	1759

Valentin	Suhl	1586
Valley Forge	Philadelphia	1742–1842
Valvasor, Geo. Fed.	Austria	1680–1714
Vavvan	France	1633–1707
Veban (? Verban) Dietrich	Unknown	1668
Venazolo, Antonio	Italy	1670
Ventre, John Baptis	Paris	1600
Ventura, Diego	Madrid	1760
Verban, Dietnor	Flanders	1668
Vernias	Boulogne	1760
Vett, J. Jos.	Germany	1790–1810
Vetter	Switzerland	1869
Vitelli, Camillio	Pistoria	1540
Voigt, Christian	Altburg	1790–1810
Volcanic Arms Co.	New Haven, U.S.A.	1860
Vlodas, Daniel	Maastricht	1740
Volvert	Lancaster, Penn.	1775
Volvert	Lancaster, U.S.A.	1775
Vondegrift	Bucks County, Penn.	1775
Vondersmith	Lancaster, U.S.A.	1783
Waas	Bamberg	1800
Walch, J.	Brooklyn, U.S.A.	1859
Walch F. A. Co.	New York	1859
Walch, John	New York	1859
Walters	Milbury, Mass., U.S.A.	1837
Waldren, Alex.	Mass.	1672
Waldren, William	Boston	1671
Wallace, V. M.	New York	1835
Walster	Saarbruck	1770–1800
Ward, H. D.	Mass., U.S.	1863
Warner, James	Mass., U.S.	1851–57
Washugen, A.	Germany	1690
Wastler	Germany	1760
Waters, Andrus	Mass., U.S.	1776
Waters, Asa	Mass., U.S.	1776
	Second generation	1789–1841
Waters, Richard	Salem, U.S.	1632
Weber & Schultpan	Frankfort	—
Weignadt	Germany	1725
Welton, Ard	Connecticut	1778
Wenger, Max	Augsburg	1650
Werder, Felix	Unknown	1652
Werner, C. G.	Leipsig	1750–80
Wertschagen Ltd.	Willingenc	1770–1800
Wesson, Edwin	Connecticut	1849
White	U.S.	1890
Whitney, E.	Whitneyville, Connecticut	1856
Whitney, Eli	Connecticut	1798–1825
Whittemore, Amos	Boston	1775
Williamson, D.	U.S.	1868
Winck, Heinrich	Breslau	1750
Wincke, Henrich	Breslau	1610
Withers, Michael	Lancaster, U.S.A.	1780
Wittn, Jos. Fro.	Vienna	1750
Wolff, Paul	Austria	1684–96
Wolfheimer, Philip	Lancaster, U.S.A.	1780
Wolftan	Nuremberg	1561
Wonsitzer, Herman	Nuremberg	1554
Wood, John	Boston	1724
Woods, Luke	Mass.	1800
Woods, T.	Philadelphia	1810
Wurfflein, W.	Philadelphia	1880–1900
Wys	Zurich	1785–88
Xavier, Jacinto	Lisbon	1797
Youmans	Lancaster, Penn.	1775
Young	U.S.	1898
Young, Henry	Easton, Penn.	1783
Young, H.	Easton, Penn.	1776
Young, P.	Penn.	1783
Yost, John	Maryland	1775
Yvrande	Rennes	1666
Z.	Mark of J. A. Kuchenreuter	
Zachtler, J. S.	Unknown	1665
Zarandana	Eibar	1820
Zarandosa	Eibar	1790
Zelle(r), Christi	Austria	1648–64
Zellerin, Marc	Vienna	1750
Zellner, Caspar	Vienna	1680–1775
Zelner, Balthasar	Vienna	1720
Zelner, Marcus	Vienna	1580
Zergh, Jean	Austria	1790–1810
Zergh, Jean	Germany	1790
Zierler, Andrea	St. Veit	1588
Zimmerman, Hans	Kopenhagen	1695
Zirkl	Germany	1664–65
Zollner, Killian	Salzburg	1620
Zuloaga, Ramon	Madrid	1810
Zulouga, Placido	Eibar	1810
Zurich	Vienna	1790–1810
Zuzer, J. G.	Arnheim	1850

APPENDIX VII

ADDITIONAL NOTES

HAND firearms appear to have been made at Eichstadt in 1487; Cologne, 1501; Augsburg, 1508; Innsbruck, 1518; Ferlach, 1525.

Paper for cartridges was introduced at Gratz in 1587, and we find in the list of weapons bought by the Gratz arsenal various entries from 1587 to 1592 in which firearms *mit schnapper* as distinct from *rad schloss* or wheel lock are delivered. These were probably the earlier forms of pyrites and flint locks. Bandoliers were not known in 1568, but evolved as soon as the paper wrapped cartridge was put into service.

Sir Thomas Gresham imported from Antwerp 1500 hand guns at seven shillings apiece and some 1800 dagges or pistols at sixteen shillings and eightpence apiece. These came in during the year 1559–1560. Burgon's *Life and Times of Sir Thomas Gresham*, Vol. I, p. 478.

Sir Roger Williams, *c.* 1559, records: "For the recoyling there is no hurt, if they be straight stocked after the Spanish manner, were they stocked crooked after the French manner, to be discharged on the breast, few or none could abide their recoyling, but being discharged from the shoulder after the Spanish manner there is neither danger nor hurte." *Ancient Armour*, Hewit, 1860.

Ce meme jour arrive a Paris 200 archiers dont estoit capitaine Mignon, tout lesquels estoit bien en poinct au nombre desquels il y avoit plusieurs crinequiniers, voulgiers et couleuvriniers à main. *Chronique de Jean de Troyes*, 1460.

The date of the first match lock pistol is unknown, but German authors claim 1423 for a specimen in the Musée Germanique.

Fourteenth century use of firearms is chronicled by Schön (*Geschichte des Handfixuer waffen*, Dresden, 1858) as Battle of Rosbecq, 1332; Siege of Trosky in Lithuania, 1383; Padua, 1386; Swiss campaign, 1392. The pieces used by the Swiss were more cannon than gun and required two men to handle them. By 1411 the Duke of Orleans possessed some four thousand "armes a feu portatif."

APPENDIX VIII

SOME ADDITIONAL NOTES ON THE LONDON MAKERS OF 1714 TO 1718

THE gun trade of this time was centred in the Minories and parts of the city near the Tower. Apart from private trade there was the staple industry of supplying Service weapons for use in the Army and in the Navy.

Arms were remodelled and reissued, and the Tower may be looked on as an issuing warehouse for raw material, as well as a purchasing institution.

The Office of Ordnance would contract with gun makers and issue to them rough tubes or materials to work up. In the Tower were viewers and "frobishers," i.e. polishers and cleaners, who also repaired and made serviceable part-worn arms.

The period of 1714 to 1718 covers the last few months of Queen Anne and the earliest years of George I. The demand for arms may be taken as rather more than normal, for the wars of the Spanish Succession had been closed in 1713 by the Peace of Utrecht. The 1715 Rising of the Jacobites had produced a localized disturbance, and it was clear that supplies for the troops had to be maintained. On the other hand there were no extensive military operations, and the bulk of the orders appear to have been for "Land service musquetts" to the official pattern. "Sea service arms" were apparently made up out of old Army issues rejected from service. In addition there were "East India muskets," "fusees" and "pistolls."

The series of bills, payments, etc., has still been preserved and comprises four large ledgers of MSS. From it one can obtain some idea of the relative turnover and standing of the gun makers of the period. The Office of Ordnance of 1714, just like the Ministry of Munitions of 1917, issued orders to manufacturers according to their capacity for output.

A typical order is as follows:

GUNMAKERS. OFFICE OF ORDNANCE. 13 *July*, 1714.

In pursuance of an order this day of the Board you are to receive out of Her Majesty's stores within this office the number of musquett barrels

appointed to be delivered to each of you according to the several classes underwritten and forthwith cause the same to be taken bored and breached and returned into the said stores.

1st Class.

Edward Turvey.
Richard Loader.
Wm. Nutt.
Charles Kipling.
Wm. Heasler.
James Goodby.
Wm. Predden.
George Aldrige.
John Williams.
Eliza Towle.
Thos. Towle.
Mary Gough.
Robt. Gough.
Sarah Bye.
Francis Smart.
John Sibley.
John Hawkins (Senior).
Lanc Ebbutt.
John Tittensor.
Edwd. Loader.
(each 110 barrels.)

2nd Class.

Frank Philips.
Thos. Green.
Richd. Dyer.
Tho. Saunders.
Jo. Bunday.
Wm. Sowerby.
James Peddal.
Humphry Pickfatt.
Peter Bolton.
John Vaughan.
Thos. Wright.
(each 80 barrels.)

3rd Class.

Richard Kipling.
Wm. Moore.
Simon Harison.
Robt. Sibthorpe.
Geo. Smithett.
Ralph Stringer.
John Johnson.
Wm. Rose.

4th Class.

John Hall.
John Brooke (Junior).
Wm. Brasier.
Richd. Wilford.
James Haynes.
John Hawkins (Junr.).
(each 40 barrels.)

3rd Class.
Wm. Huggins.
Mary Fort.
John Brooke.
Isaac Morris.
Stephen Powell.
Thos. White.
Thos. Philips.
Chris. Jackson.
(each 60 barrels.)

4th Class.
John Brush.
(62 barrels.).

John Hawkins (Senior) for Mary Margaret Laurance.
(60 barrels.)

This gives us fifty-five workers of the period of whom at least a dozen are also known to have made better quality private weapons. The names show how the trade ran in families, the list including three separate John Hawkins, two Loaders and two Brookes. Many of these names can be traced back to dated pieces thirty years earlier, but it is not easy to determine which member of a family or which generation of workers made a given piece.

In this year of 1714 we still find the trade supplying " plain locks " and " bridle locks." The heel plates, trigger guards and side plates are usually of brass, and the stocks of " good walnutt wood " have to be " first viewed and markt by the proper person at the Stock makers."

In December, 1715, Wm. Burgin is ordered to supply " 100 setts of brass work for Pistolls to weigh each one pound and a quarter." This may relate to the heavy dragoon pistols, although the mass of mounts of these does not weigh from specimens examined more than half this amount. Alternatively these may have been the gun-metal or brass-butted Highland pistols issued to Scottish regiments. The price for these arms complete was twenty-seven shillings the pair. The price for muskets was eight shillings and ninepence apiece, the barrels and stocks being supplied ex-Tower stores. Orders were also given for "Trading guns East India Bore stockt and set up with H. Mjst's. barells, locks and brass work."

James Holt delivered in 1718 no less than 115,900 gun flints at five shillings and sixpence per thousand. His order was for 200,000 musket flints, 10,000 carbine flints and 15,000 pistol flints. John Thompson supplied musket rods and Richard Ward stocks as well as muskets.

There were other than the classified workers given in the order quoted. In bills for 1714 we find in addition:

Richard Sinckler.	Wm. Lord.
Thos. Wright.	John Winsup.
Richard Kysling.	John Drew.

The engraving of locks with the Royal cipher and the Crown was done by engravers at fourpence apiece. The famous William Caslon, whose exquisite type fount is still unsurpassed for printing, was given a contract to engrave the Royal cipher on arms on December 6, 1716. For each piece he was paid threepence. It is therefore quite possible that any Tower musket lock of this or later date is from the chisel of William Caslon himself! Previous to this arms were engraved by Banbury at fourpence and locks were issued in batches of a thousand or more for engraving. It is possible that he also cut the stamps or dies for the gun-makers' private marks.

By 1716 new names appear in the bills:

Elias Cole.	John White.
Hugh Powell.	Thomas Hollies.
John Pringle.	Henry Kirkham.
John Willowes.	James Haynes.
Evan Loyd.	John Warsop.

By 1717:

Edward Sale.	John Thompson.
Edwd. Weston.	Richd. Heasler.
Wm. Green.	

By 1718:

Benjamin Carter.	John Barn.
Wm. Everard.	Richd. Waller.
John Dennison.	Joseph Collett.
Joseph Farmer.	Richd. Ward.
Wm. Green.	Thos. Phillips.
Thos. Probin.	Edwd. Cooke.
Mary Burgin.	

The women gunsmiths are rather remarkable, but it is probable that they were widows still carrying on the businesses of defunct husbands with the work of apprentices.

It would not be safe to assume that because a given maker's name does not appear in these bills at this time that therefore he was not in existence. These were Government contracts and it is possible that many of the better craftsmen did not always take up this class of work.

The need for marks other than initials is clearly shown by the correspondence of initials. R.W. may stand for Richard Waller, Richard Ward or Richard Wilford ; W.E. for William Everard or Edward Weston ; and until sufficient information has been got together the dating of the gun makers' plate marks must be purely speculative.

INDEX

N.B.—An asterisk after the page number denotes that the reference will be found in a footnote.